

Watershed Analysis

Elkton-Umpqua WAU
(Watershed Analysis Unit)

Roseburg District BLM

Updated as of
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Version 1.1

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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OVERVIEW OF ELKTON-UMPQUA WAU

A. General Description

Size and Location: Elkton-Umpqua Watershed Analysis Unit (WAU) contains approximately 90,125 acres. Covering 141 square miles, it is located on the lower slopes and valleys along the main Umpqua River as it cuts through the coast range mountains south of the city of Elkton as well as the lowest subwatershed of Elk Creek to the northwest of Elkton (Figure 1-1). Elkton-Umpqua WAU covers portions of two fifth field watersheds, the Upper Umpqua and Elk Creek watersheds. It mostly consists of low gradient coastal riverine type habitat which are a part of and flow into the Umpqua river at Elkton. The Umpqua river system which includes the North and South Umpqua encompasses approximately 1300 square miles that flows 200 miles from the Cascade crest through the Oregon Coast Range to the Pacific Ocean.

Specific Description: Upper Umpqua and Elk Creek watersheds are both 5th field watersheds. Upper Umpqua contains approximately 169,476 acres and consists of 9 subwatersheds. Elk Creek contains approximately 224,310 acres and consists of 13 subwatersheds. Elkton-Umpqua WAU was selected as the analysis unit for several reasons: 1)To make the information be of a more manageable size 2)To cover in one analysis BLM lands that are scattered amongst a high percentage of private lands 3)And to analyze one subwatershed of the Elk Creek watershed that had not already been analyzed (all except the subwatershed at the mouth of Elk Creek have been previously analyzed). Elkton-Umpqua WAU stretches approximately 9 miles south to north and 7 miles east to west. The Umpqua River flows through the middle from south to the north and Elk Creek flows into the Umpqua River from the northeast at the city of Elkton. This WAU also contains portions of State Hwy 38 and 138 (Figure 1-2). The elevation ranges from about 80 feet around the city of Elkton in the northwest portion, to 2600 feet on Tyee Mountain at the southern tip of the WAU, to 2,456 feet at Yellow Butte on the eastern side, and 2,307 feet on a peak at the headwaters of Waggoner Creek on the western side. The mountain ranges encompassing this WAU average less than 2,000 feet. This WAU is made up of 5 major subwatersheds: Elkton, Yellow Creek, Lost Canyon, McGee Creek, and Mehl Creek. These subwatersheds are also divided into 25 drainages (Figure 1-3, Table 1-1).

Climate and Vegetation: Average annual rainfall ranges from 50 inches along the Umpqua River, to 70 inches in the upper elevations to the west and east. Most of the precipitation occurs in the form of rain since about 93% of the WAU has elevations below 2000 feet. The majority of the landscape is dominated by seedling and young second growth Douglas-fir. This is a result from harvesting the older timber stands during the last 100 years and replanting of those lands to Douglas-fir. The valley bottoms maintain a mixture of oak and madrone woodlands amongst the agriculture/pasture lands.

People and Recreation: This WAU is sparsely populated with the city of Elkton at approximately 180 people. State highway 38 is a major connector route between the Willamette Valley and the Pacific Coast. State highway 138 which becomes state highway 38 at Elkton is also major connector route between the Umpqua Valley and the Pacific Coast. For recreation opportunities, Douglas County maintains a boat ramp near Yellow Creek and the Madison Wayside near Kellogg. BLM's primary recreation development is the Tyee Recreation Site (Figure 2-1). The demand for camping facilities in the area has grown to the point that BLM is planning to build an additional campground, Eagleview Recreation Site, just downstream from Tyee Recreation Site. An increased demand for recreation opportunities has also led to the development of the Big K Ranch, a private resort in the central portion of the watershed.

B. Ownership and Federal Land Use Allocations

The following is a breakdown of the private land owners and federal administration (Figure 1-4). Although acreage for major private land owners was not obtained for this analysis, the major private land owners include Bob and Carol Whipple, Roseburg Resources Co. and its affiliate West Coast, Lone Rock Timber Co., and Carol Beck.

<u>Land Owner</u>	<u>Acres</u>	<u>Percent of Watershed</u>
Government (BLM)	29,761	33%
Private & Other	60364	67%

Of the 90,125 acres within Elkton-Umpqua WAU, approximately 29,761 acres (33%) is federally managed under the following Forest Plan and Roseburg District RMP land use allocations (Figure 1-5, Table 1-2) (note: these acreages

are estimates based on computer generated maps):

	<u>Acres, Fed Lands</u>	<u>% Fed Lands</u>	<u>% of Watershed</u>
Late Successional Reserves (LSR)	20,917 ac	70%	23%
Other Reserves	4,169 ac	14%	4.6%
Connectivity	505 ac	1.7%	0.6%
General Forest Management Area (GFMA)	4,171 ac	14%	4.6%

1. Late Successional and Other Reserves

The management objectives for all reserves are to protect and enhance old-growth forest conditions. Of the 25,063 acres of reserves in Elkton-Umpqua WAU, approximately 6,017 acres (24% of reserves in Elkton-Umpqua) are currently in late-successional type forests (80 to 200 years) and approximately 7,649 acres (31% of reserves in Elkton-Umpqua) are currently in old growth type forests (200+ years) (Figure 1-6, Table 1-3).

The Other Reserves as shown on figure 1-5, include riparian reserves, unmapped pre-1994 Northern Spotted Owl (NSO) designated habitat areas such as Bald Eagle habitat, and areas withdrawn because they are considered not suitable for timber production (TPCC).

The riparian reserves were established on federal lands as one component of the Aquatic Conservation Strategy to protect the health of the aquatic system and its dependent species and provide incidental benefits to upland species. The reserves were designated to help maintain and restore riparian structures and functions, benefit fish and riparian-dependent non-fish species, enhance habitat conservation for organisms dependent on the transition zone between uplands and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat (ROD, B-13).

The riparian reserves were estimated from the stream network characterized by the Geographic Information System (GIS) computer database as well as on the ground verification and mapping of intermittent (1st and 2nd order) streams. A slope distance of approximately 200 feet was used as representing the average site-potential tree height for both the Upper Umpqua watershed as well as the Elk Creek watershed (ROD, pg. 9). In the Upper Umpqua watershed site-potential tree height of 200 feet was determined from 7 plots taken on the lower one-third of the hill slopes. In the Elk Creek watershed site-potential tree height of 200 feet was determined from 24 plots taken on the lower one-third of the hill slopes in the Elk Creek watershed. Thus the following riparian reserve widths were used for the estimating the total amount of riparian reserves: 200 feet (61 meters) for intermittent, non-fish bearing streams and 400 feet (122 meters) for fish bearing streams. Actual field intermittent streams are unmapped and known fish bearing streams are estimated based on a fish presence/absence inventories and professional knowledge on the ground. For this analysis the total amount of riparian reserves was estimated for mapping purposes so that third order streams and larger received a 400 foot buffer while the documented first and second order streams received 200 foot buffers. Actual projects would use on-the-ground stream information to establish Riparian Reserves.

In Elkton-Umpqua WAU there are 29 known NSO sites with most of these within LSRs. Outside LSRs there are six residual habitat areas that protect seven core areas. These areas are expected to provide some protection for nesting groves found to be suitable by owls in the past. They are not, in themselves, expected to be capable of supporting pairs of nesting owls, but rather to provide nesting habitat in the future while the surrounding forest stands mature.

Areas designated as not suitable for timber production (TPCC withdrawn) are much smaller and scattered.

As part of the Late Successional Reserve land use allocation, several areas were reserved from timber management in order to protect potential nesting habitat for the marbled murrelet. These areas are described as marbled murrelet reserves as opposed to designated critical habitat. These areas were selected because they contain potential habitat based on the presence of several key habitat elements within the estimated range of the species. The elements include large diameter (32 inch+ DBH) trees, a canopy layer height equal to or greater than 1/2 the site potential tree height, structural deformities, mossy large limbs or other conditions which create nesting platforms.

2. Matrix Lands

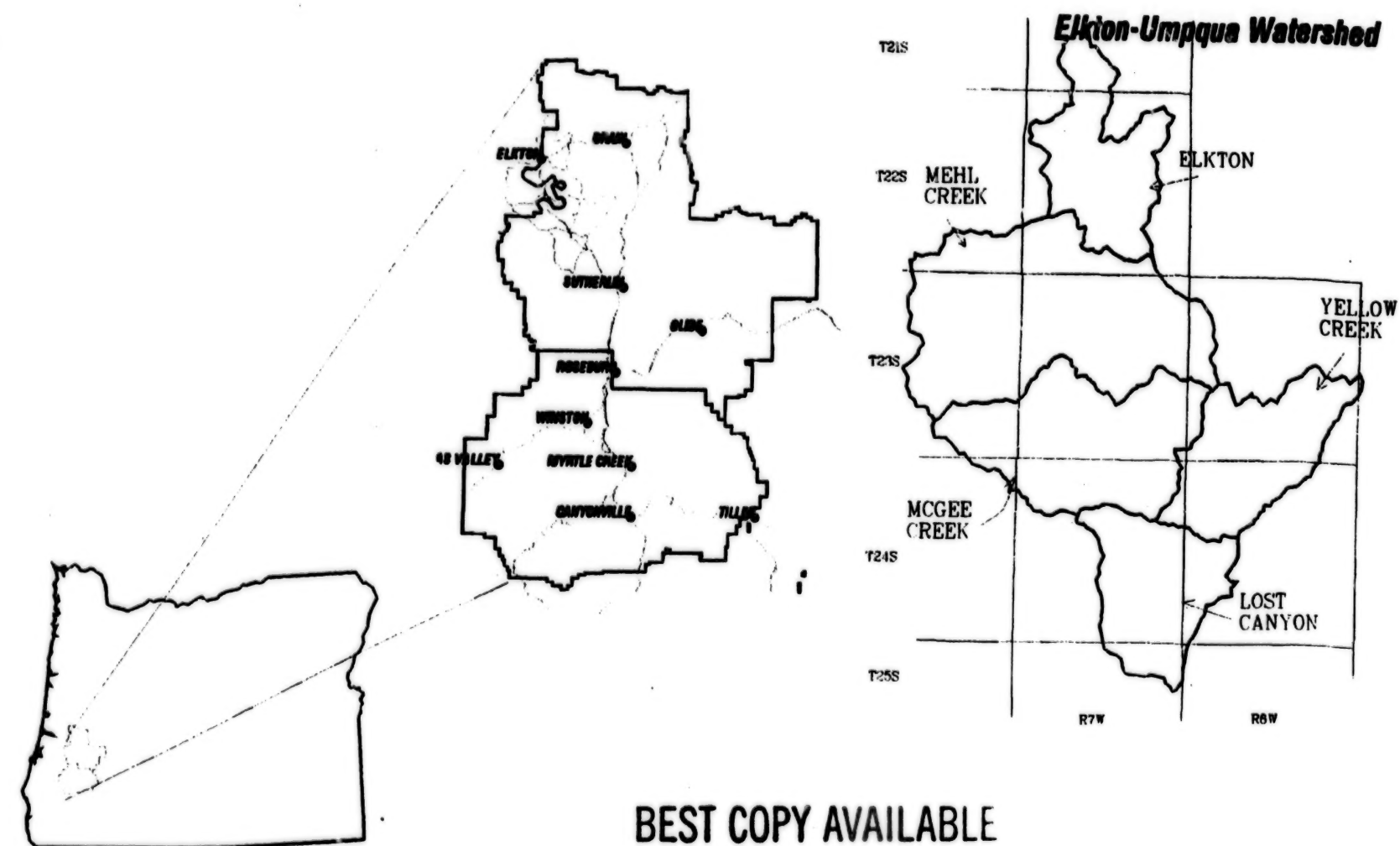
a. Connectivity

The objective of these lands on the overall landscape is to provide a bridge between larger blocks of old growth stands and Riparian Reserves. This provides habitat for breeding, feeding, dispersal, and movement of old growth-associated wildlife and fish species. Elkton-Umpqua WAU contains approximately 505 acres of Connectivity. Once Riparian and Other Reserves are taken out of this land use allocation, the Elkton subwatershed contains the largest amount of this designation at 400 acres (Table 1-4). Within this land designation there are approximately 275 acres in young pre-commercial age class (0 to 30 years), 121 acres potentially available for a commercial thinning (30 to 80 years), and 109 acres available for regeneration harvest (80+ years) (Figure 1-7, Table 1-4).

b. General Forest Management Area (GFMA)

The objective of these lands is to manage on a regeneration harvest cycle of 70 to 110 years, leaving a biological legacy of 6 to 8 trees per acre to assure forest health. There is approximately 4,171 acres of GFMA in Elkton-Umpqua WAU. Within this land designation there are approximately 1,784 acres in young pre-commercial age class (0 to 30 years), 1,087 acres potentially available for a commercial thinning (30 to 80 years), and 1,300 acres available for regeneration harvest (80+ years) (Figure 1-8, Table 1-5).

Figure 1-1



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Elkton-Umpqua Watershed Analysis

Vicinity Map

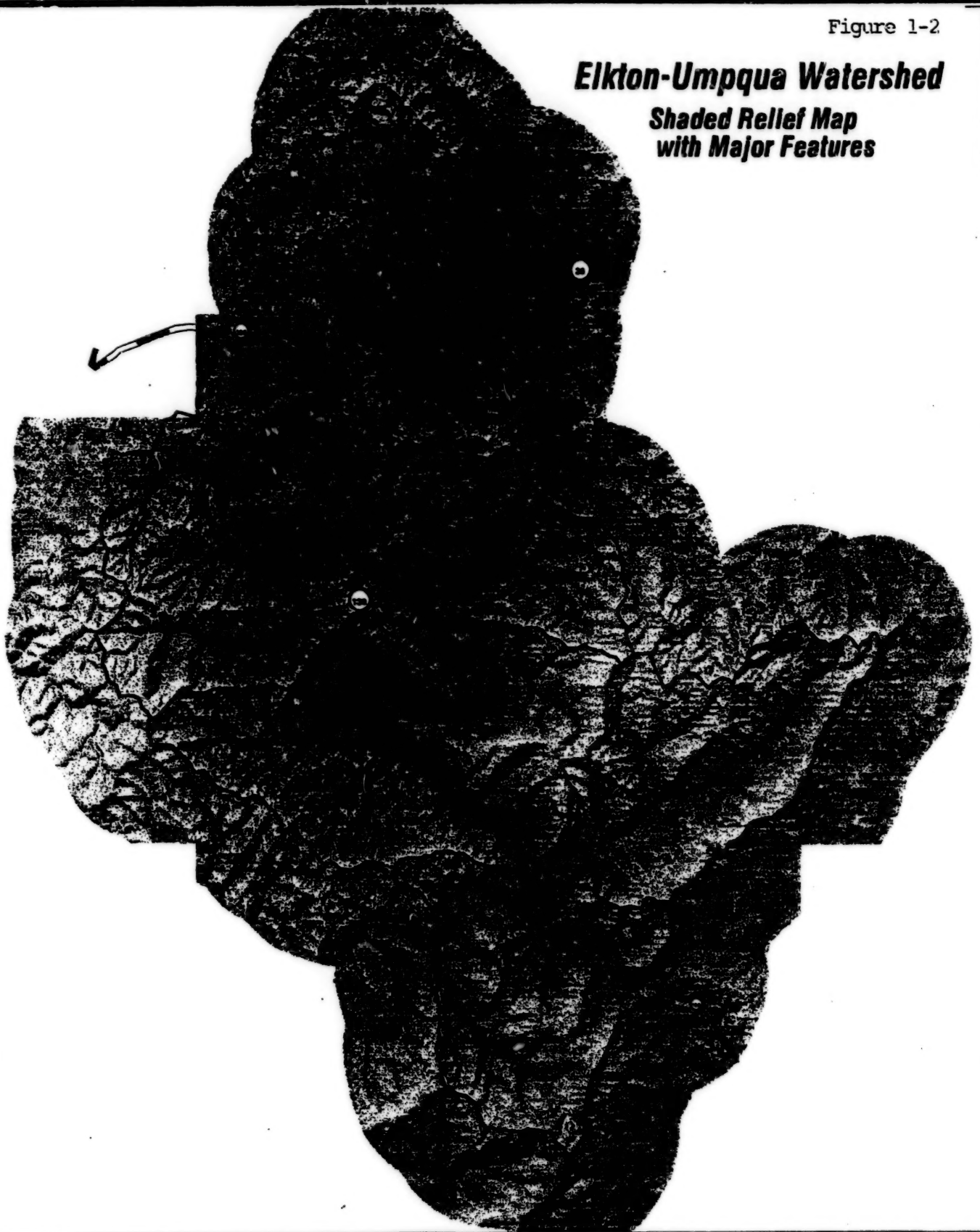
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Map 1

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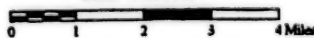
Figure 1-2

Elkton-Umpqua Watershed

Shaded Relief Map with Major Features



Scale 1:180000



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- Watershed Boundary
- Streams and Rivers
- Cities and Towns
- Federal/State Highways



Elkton-Umpqua WAU

Subwatersheds & Drainages

T21S

T22S

T23S

T24S

MEHL
CREEKSMITH
FERRY
FRONTALELKTON
FRONTAL

LITTLE TOM

ELK OVERPASS

ELKTON

LOWER ELK

HANCOCK

1 0 1 2 Miles

1:148843

HEDDIN
CREEKPHIPPS
POINT

FRONTAL

WILLIAMS

BRADS CREEK

YELLOW
CREEKMEHL
CREEKFITZPATRICK
CREEK

KELLOGG

MARTIN
CREEKBEAR
DOEUPPER
YELLOWWAGGONER
CREEKHUTCHINSON
WAYSIDEDEEP
GULCHLOWER
YELLOWMCGEE
CREEK

MCGEE CREEK

TYEE REC

BULLOCK BRIDGE

LEGEND

-  Subwatersheds
-  Drainages
-  Text Section
-  4th Order+ Streams
-  Umpqua River & Lakes
-  Ownership
-  BLM
-  Private & Other

LOST CANYON

LITTLE
CANYON CREEKLOST
CANYON

R8W

R7W

R6W

1-6

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Table 1-1

ELKTON-UMPQUA WAU SUBWATERSHED & DRAINAGE ACREAGES

Subwatershed Name	Drainage Name	BLM Acres	%	Private/Other Acres	%	Total Acres
	ELK OVERPASS	1239	43%	1673	57%	2912
	ELKTON FRONTAL	504	27%	1394	73%	1897
	HANCOCK	627	25%	1917	75%	2544
	LITTLE TOM	1831	50%	1826	50%	3657
	LOWER ELK	195	12%	1389	88%	1585
ELKTON		4396	35%	8199	65%	12595
	BULLOCK BRIDGE	25	4%	569	96%	594
	LITTLE CANYON CREEK	1712	37%	2952	63%	4664
	LOST CANYON	2359	47%	2700	53%	5059
	TYEE REC	873	33%	1754	67%	2627
LOST CANYON		4969	38%	7975	62%	12944
	DEEP GULCH	738	27%	1986	73%	2725
	HUTCHINSON WAYSIDE	316	13%	2178	87%	2495
	KELLOGG	316	7%	4528	93%	4844
	MARTIN CREEK	1302	51%	1240	49%	2542
	MCGEE CREEK	1343	38%	2204	62%	3547
	WAGGONER CREEK	1484	38%	2400	62%	3883
MCGEE CREEK		5499	27%	14536	73%	20035
	BRADS CREEK	1888	46%	2221	54%	4109
	FITZPATRICK CREEK	1015	48%	1080	52%	2094
	HEDDIN CREEK	1036	38%	1659	62%	2695
	MEHL CREEK	2600	45%	3203	55%	5803
	PHIPPS POINT	0	0%	2148	100%	2148
	SMITH FERRY FRONTAL	270	4%	7330	96%	7600
	WILLIAMS FRONTAL	682	10%	5877	90%	6559
MEHL CREEK		7490	24%	23518	76%	31008
	BEAR DOE	1925	59%	1351	41%	3276
	LOWER YELLOW	2005	48%	2186	52%	4192
	UPPER YELLOW	3477	57%	2597	43%	6075
YELLOW CREEK		7407	55%	6135	45%	13542
TOTAL WAU		29761	33%	60364	67%	90125

Elkton-Umpqua WAU**Ownership & Major Streams**

T21S

T22S

T23S

T24S

**MEHL
CREEK****ELKTON****YELLOW
CREEK****MCGEE
CREEK****LOST
CANYON****LEGEND**

-  Subwatersheds
 Text Streams
 Text Section
 4th Order+ Streams
 Umpqua River & Lakes
Ownership
 BLM
 Private & Other

BLM	29761.00
Prvt	60364.00
TOTAL	90125.00

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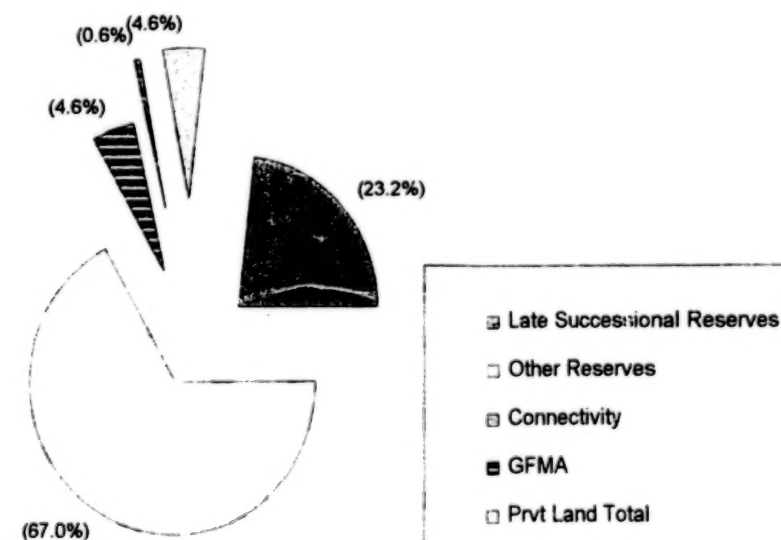
ELKTON-UMPQUA LAND USE ALLOCATIONS

	LAND USE ALLOCATIONS										
	Late Successional Reserves		Other Reserves		Connectivity		GFMA		Private Lands		TOTAL
Subwatersheds	acres	%	acres	%	acres	%	acres	%	acres	%	ACRES
Elkton	2223	17.6%	1219	9.7%	400	3.2%	555	4.4%	8199	65.1%	12596
Lost Canyon	4121	31.8%	312	2.4%	0	0.0%	537	4.1%	7975	61.6%	12946
McGee Creek	3744	18.7%	809	4.0%	10	0.0%	938	4.7%	14536	72.5%	20037
Mehl Creek	5261	17.0%	1283	4.1%	64	0.2%	878	2.8%	23518	75.9%	31005
Yellow Creek	5567	41.1%	546	4.0%	31	0.2%	1263	9.3%	6135	45.3%	13542
TOTAL	20917	23%	4169	5%	505	1%	4171	5%	60364	67%	90124

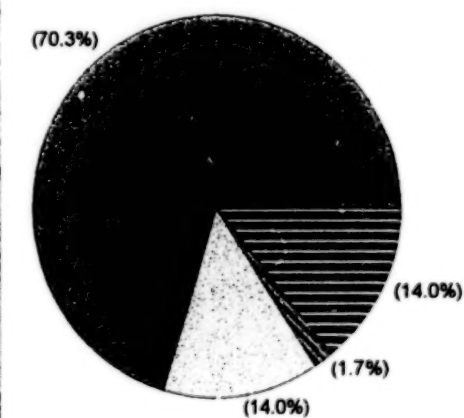
Total Land Use Allocations

Late Successional Reserves	Other Reserves	Connectivity	GFMA	Prvt Land Total	BLM Land Total
20917	4169	505	4171	60364	29761

Elkton-Umpqua Total Land Use



Elkton-Umpqua Federal (BLM) Land



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Elkton-Umpqua WAU**Land Use and
Seral Age Classes**

T21S

T22S

**MEHL
CREEK****ELKTON**

1 0 1 2 Miles

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T23S

**YELLOW
CREEK****MCGEE
CREEK****LEGEND**

- Subwatersheds
- Text
- Section Lines (Lli)
- Streams (3+ Order)
- Umpqua River
- Late Successional Reserves
- Other Reserves
- Matrix Lands
- Late Seral
- Mid Seral
- Early Seral
- Pending or Recent Cut Sales

T24S

**LOST
CANYON**

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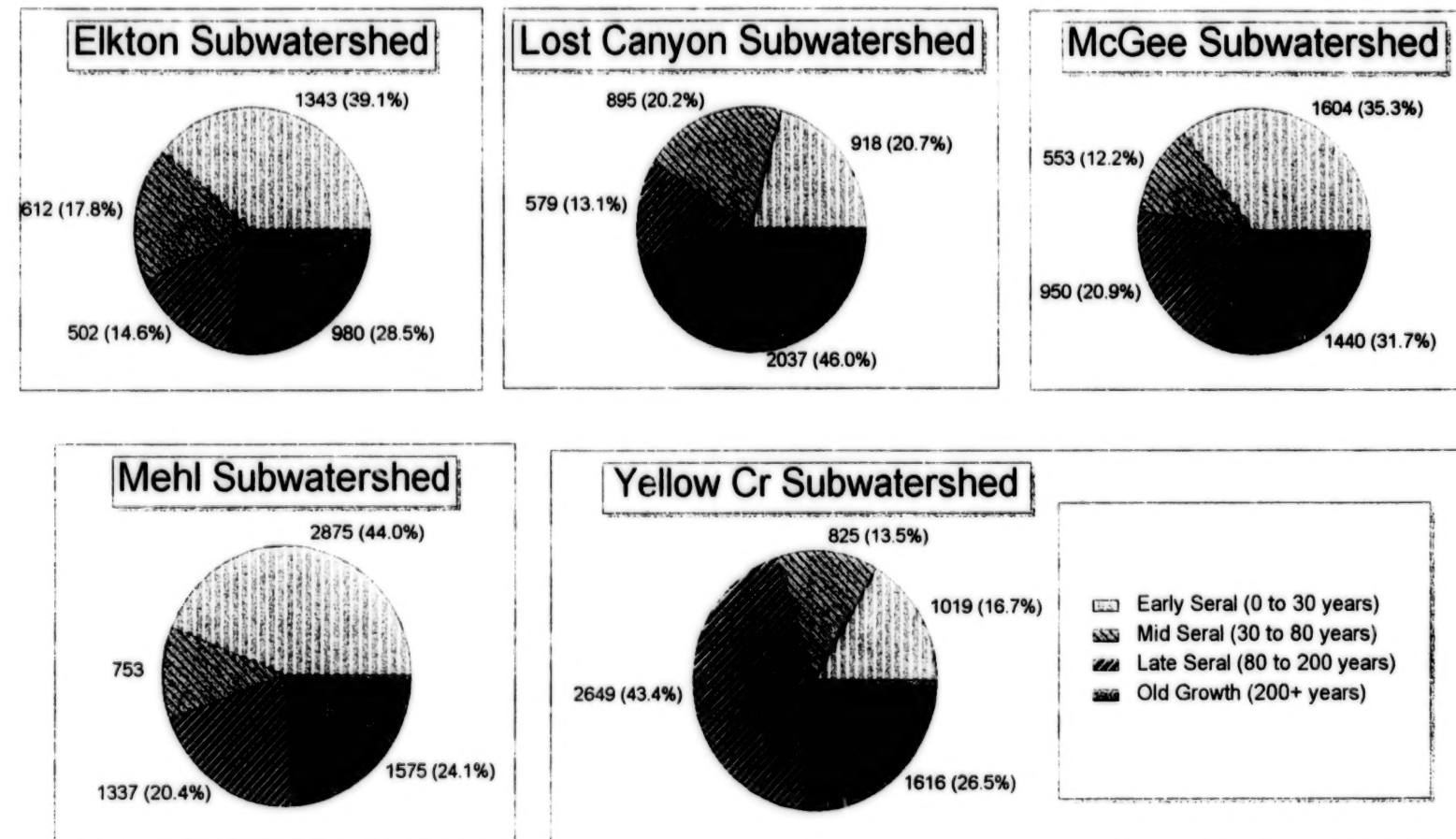
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ELKTON-UMPQUA ALL BLM RESERVES, AGE CLASSES

	ALL BLM RESERVES, AGE CLASSES								
Subwatersheds	Early Seral (0 to 30 years)		Mid Seral (30 to 80 years)		Late Seral (80 to 200 years)		Old Growth (200+ years)		TOTAL ACRES
	acres	%	acres	%	acres	%	acres	%	
Elkton	1343	39.1%	612	17.8%	502	14.6%	980	28.5%	3438
Lost Canyon	918	20.7%	895	20.2%	579	13.1%	2037	46.0%	4429
McGee Creek	1604	35.3%	553	12.2%	950	20.9%	1440	31.7%	4547
Mehl Creek	2875	44.0%	753	11.5%	1337	20.4%	1575	24.1%	6541
Yellow Creek	1019	16.7%	825	13.5%	2649	43.4%	1616	26.5%	6109
TOTAL	7759	31%	3638	15%	6017	24%	7649	31%	25063



Elkton-Umpqua WAU

Seral Age Classes in BLM Reserves

T21S

T22S

MEHL CREEK

ELKTON



1 0 1 2 Miles

1:141277

T2

YELLOW CREEK

MCGEE CREEK

LEGEND

T24S

-  Subwatersheds
-  Section
-  Section Lines (1li)
-  Streams (3+ Order)
-  Umpqua River
-  1995 Recision Act Sales
-  Early Seral (0-30 yrs)
-  Mid Seral (30-80 yrs)
-  Late Seral (80-200 yrs)
-  Old Growth (200+ yrs)

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R6W

LOST CANYON



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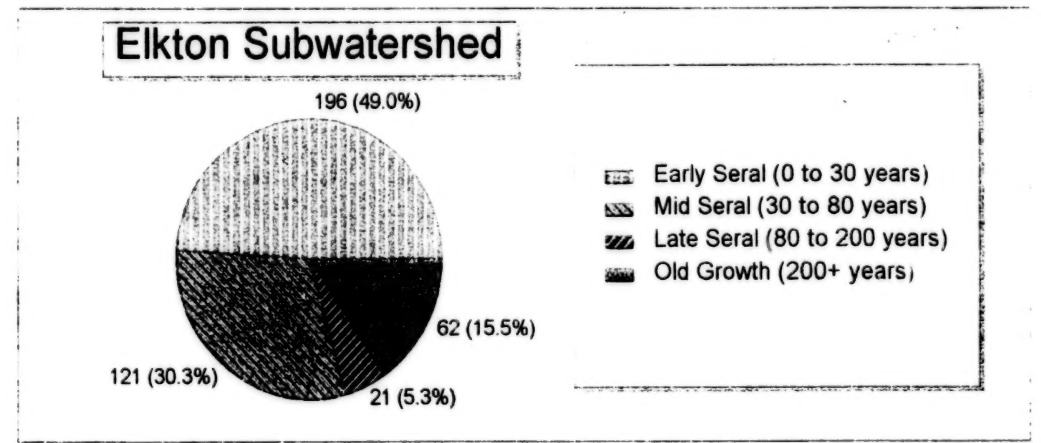
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ELKTON-UMPQUA CONNECTIVITY LANDS, AGE CLASSES

	CONNECTIVITY LANDS, AGE CLASSES								
Subwatersheds	Early Seral (0 to 30 years)		Mid Seral (30 to 80 years)		Late Seral (80 to 200 years)		Old Growth (200+ years)		TOTAL ACRES
	acres	%	acres	%	acres	%	acres	%	
Elkton	196	49.0%	121	30.3%	21	5.3%	62	15.5%	400
McGee Creek	10	100.0%	0	0.0%	0	0.0%	0	0.0%	10
Mehl Creek	53	82.8%	0	0.0%	11	17.2%	0	0.0%	64
Yellow Creek	16	51.6%	0	0.0%	0	0.0%	15	48.4%	31
TOTAL	275	54%	121	24%	32	6%	77	15%	505



T21S

Elkton-Umpqua WAU**Seral Age Classes
in BLM Connectivity Lands**

T22S

**MEHL
CREEK****ELKTON**

1 0 1 2 Miles

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T23S

**YELLOW
CREEK****MCGEE
CREEK**

T24S

LEGEND

- Subwatersheds
- Text Section
- Section Lines (lli)
- Streams (3+ Order)
- Umpqua River
- Old Growth (200+ yrs)
- Late Seral (80-200 yrs)
- Mid Seral (30-80 yrs)
- Early Seral (0-30 yrs)

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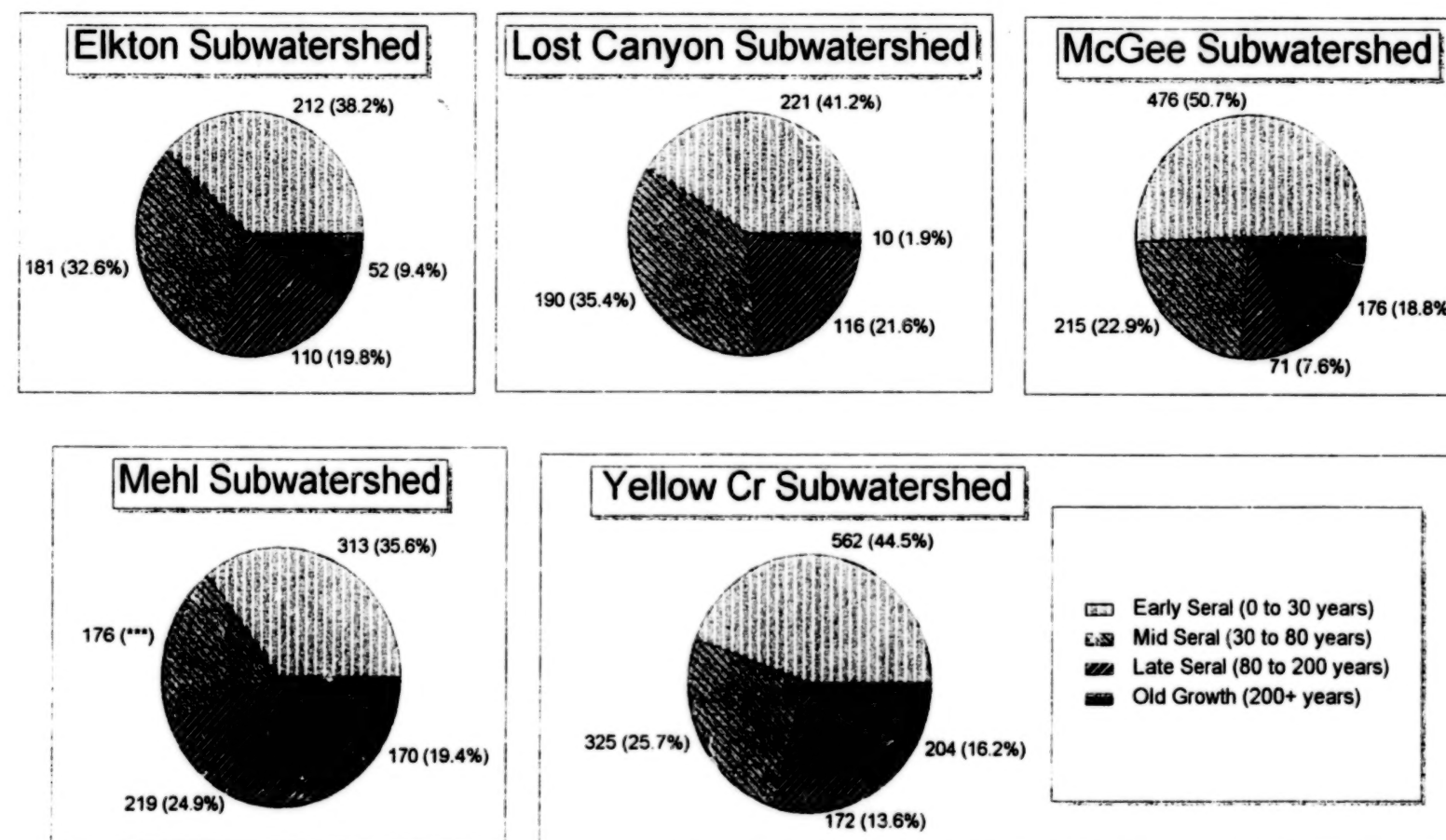
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CANYON**

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ELKTON-UMPQUA GFMA LANDS, AGE CLASSES

GFMA LANDS, AGE CLASSES									
Subwatersheds	Early Seral (0 to 30 years)		Mid Seral (30 to 80 years)		Late Seral (80 to 200 years)		Old Growth (200+ years)		TOTAL ACRES
	acres	%	acres	%	acres	%	acres	%	
Elkton	212	38.2%	181	32.6%	110	19.8%	52	9.4%	555
Lost Canyon	221	41.2%	190	35.4%	116	21.6%	10	1.9%	537
McGee Creek	476	50.7%	215	22.9%	71	7.6%	176	18.8%	938
Mehl Creek	313	35.6%	176	20.0%	219	24.9%	170	19.4%	878
Yellow Creek	562	44.5%	325	25.7%	172	13.6%	204	16.2%	1263
TOTAL	1784	43%	1087	26%	688	16%	612	15%	4171



T21S

Elkton-Umpqua WAU**Seral Age Classes
in BLM GFMA Lands**

T22S

**MEHL
CREEK****ELKTON**

1 0 1 2 Miles

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T23S

**YELLOW
CREEK****MCGEE
CREEK**

T24S

LEGEND

-  Subwatersheds
-  Section
-  Section Lines (1li)
-  Streams (3+ Order)
-  Umpqua River
-  Old Growth (200+ yrs)
-  Late Seral (80-200 yrs)
-  Mid Seral (30-80 yrs)
-  Early Seral (0-30 yrs)

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R6W

**LOST
CANYON**

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HUMAN USES

This write-up on Human Uses is largely derived from the Coos Bay District's Upper Middle Umpqua WA.

A. Key Questions

What were the predominant human uses of this watershed in the past up to today?

How have previous management practices affected the existing watershed?

B. Characterization

The ability to cultivate the scenic valley makes this watershed important to people. The rural human population is estimated to be around 100 families within the watershed. The population of Elkton is 180. State Highway 38 is a major route between the Willamette Valley and the Pacific Coast, a top destination for travelers within the state.

The watershed lands are generally privately owned or under BLM administrative authority. The BLM lands are nearly all forested slopes. BLM's forest management objectives have changed from featuring timber production to ecosystem management. Damaging landslides of recent wet years have raised public awareness of that hazard, adding a new element to the debate on how forests should be managed in general, and whether or not clearcutting should be used in particular. Recent changes in the State Forest Practices regulations require greater protection of riparian and aquatic values and retention of some habitat structure.

C. Current Conditions

Natural resources are a vital component of the ecosystem/human dynamics of this watershed. Major human uses include extracting forest products, agriculture, including raising cattle, sheep and grapes, and recreation activities, including camping, hunting and fishing. Today water is supplied through private wells and springs; electricity through Douglas Electric Company; sewage disposal is private septic and/or leach systems and trash may be hauled to Drain Sanitary Facility or collected by Douglas County contractors and disposed of through county operations. The town of Elkton serves as the hub for community activities, education, and services.

The use of forest products includes special forest products such as ferns, mosses, and mushrooms, but is dominated by timber production. Timber sale harvest acreage figures for the years 1954 through 1997 were pulled from the Micro*STORMS database, using the variable DENUDE.DATE. For the years 1983 through 1997 data were available for both acres and volume. For the years 1978 through 1982 only a portion of the sales have both acres and volume. For the years 1954 through 1977 only acreage figures are available. Using the data from the period 1978 through 1997 for the 72 sale units that have both area and volume figures, an average of 45.5 mbf per acre was calculated. The average was then applied to the years for which volume figures are lacking, resulting in the numbers displayed in Table 2-1. The data indicate a period of initial harvest between 1954 and 1971, averaging about 5,182 mbf per year. This was followed by a period of increased harvest between 1972 and 1988 when about 7,754 mbf were cut per year. Since 1989 about 1,482 mbf per year have come out of the watershed.

Like other uses in the watershed, recreation use focuses on natural resources. Fishing, boating, rafting, hunting, and camping are the primary activities. Recreation use in the watershed is serviced by developments on private, as well as public, land. Douglas County maintains a boat ramp near Yellow Creek and the Madison Wayside near Kellogg. BLM's primary development is Tyee Recreation Site (Figure 2-1). Visitor days at this campground have grown from 2,300 in 1991 to 3,249 in 1997, an increase of 41%. The demand for camping facilities in the area has grown to the point that BLM is planning to build an additional campground, Eagleview Recreation Site, just downstream from Tyee Recreation Site. An increased demand for recreation opportunities has led to the development of the Big K Ranch, a private resort in the central portion of the watershed. The resort offers fishing, swimming, boating, hiking and horseback riding from April to October. During the off season the facility hosts conferences and meetings.

Human uses relative to population have changed over the past two centuries. Agriculture dominates valley use, and timber production dominates use in the surrounding forests. The population remains resource dependent. An old abandoned coal mine and several homesteads are within the watershed, with evidence of early logging and railroad building in the region. The river has served as a transportation corridor for people, goods, and services since humans came to the area.

Historical human uses were largely agricultural and river related. Timber harvest was limited due to the difficulty of extraction with hand tools and poor access for transport, until after World War II. Intensive timber management resulted in a significant road system used today by more people, including those who own vehicles capable of maneuvering off roads. The region is still mostly known and used by local and regional residents and workers. Agricultural use has shifted the past 40 years from grain production to pasture lands, due to costs of irrigation, equipment, and transportation. It appears that the net amount of agricultural lands has decreased approximately 3,700 acres since 1936 apparently as some agricultural lands are converted to tree farms (Table 3-1, 3-2 Chart 3-1, 3-2). Aerial photographs and staff visits indicate trees and brush have remained along stream banks, curtailing erosion in the agricultural valley and river basin. Old photos suggest people have maintained the open, rolling lower slopes for agricultural use since arriving in the valley.

D. Past Conditions for Reference

The Umpqua River now is a major transportation corridor cutting through the Coast Range mountains, and probably has been for as long as people have lived in the region. It is known that the portion of the corridor within the Elkton-Umpqua WAU was occupied prehistorically. The wide river terraces, especially those in the central portion of the watershed, which later drew ranchers and farmers to this area also were appealing to prehistoric peoples.

Our best knowledge about mid-19th century Native American territories suggests the Umpqua Indians resided along the main stem of the river. Lower Umpqua Indian territory included the area within tidal influence, from the river mouth near Winchester Bay to the vicinity of Scottsburg. Upper Umpqua Indian territory began there and continued upriver past the confluence of the North and South Umpqua Rivers. The Yoncalla Indians occupied the watersheds formed by Elk and Calapooya Creeks, to the north and east of the Upper Umpqua territory.

While the Lower Umpqua focused on marine resources, the Upper Umpqua depended on a wide variety of subsistence activities during the year. They hunted for deer and elk, fished the river for salmon and freshwater species, and gathered foods like camas (a root crop). Undoubtedly, areas within the watershed were used in their subsistence activities. However, relatively little is known about prehistoric land use patterns among the Upper Umpqua. This is in part due to the devastation and changes caused by the epidemic of fevers which spread throughout the Native American populations of the vicinity during 1830-32.

In November 1854, Indian Superintendent Joel Palmer signed a treaty with the Umpqua and Yoncalla Indians. This ratified treaty granted to the United States all of their lands, including those in the watershed. The Native peoples first were moved away from the area to a nearby reservation created in lower Coles Valley. Within a year, turmoil between the Euro-Americans and the Indians along the Rogue River and the southwest Coast escalated into open warfare. By February 1856, this reservation had been closed and more than 300 Umpqua and Yoncalla Indians were moved to the Grand Ronde Reservation.

The earliest Euro-American outpost in the region was built on the bottom land along the south bank of the Umpqua River, across from the mouth of Elk Creek. This encampment, known as Fort Umpqua, was begun by the Hudson's Bay Company in 1836, and was used until 1851 as a base camp by fur traders and other explorers.

Permanent American settlements began in 1846, when the Scott-Applegate party entered the Umpqua Valley over a Native American trail from the upper Willamette Valley. In 1848, Captain Levi Scott established a farm along Elk Creek near Elkton. In 1850, he founded the town of Leviville, which later was renamed Scottsburg. The trail to the Willamette Valley soon was expanded into a wagon road, making transportation of goods and settlers somewhat easier. The impetus for Elkton's development came in August 1850, with the platting of the site by members of the Umpqua Exploring Expedition. Because of the wide river terraces, many of the earliest Donation Land Claims were for bottom land along this stretch of the Umpqua River.

The earliest government in Southwestern Oregon was situated in Elkton. It was named the first seat of Umpqua County on June 2, 1851, by the Territorial Legislature, and the Elkton post office opened on September 26, 1851. The Elkton Saw and Flouring Mills were erected on the banks of Elk Creek in 1873, and by 1878 the town had nearly 350 residents. The flood of November 1893, destroyed the mills, which were rebuilt in 1907. They served to process the locally-grown wheat (into "Pride of Elkton Flour") until 1924. By this time the development of a road system made it

possible to ship grains to the Willamette Valley for processing.

Railroad development into the region also occurred relatively late. About 1885, the Southern Pacific Company, successor to the O & C, surveyed a route along the Umpqua River through the Coast Range but did not build the line. In 1889, local investors formed the Umpqua River Railroad & Improvement Company, but could not raise construction capital. In 1905, the Oregon Western Railway conducted a new survey of the route and began construction in 1907. After economic downturns in 1911, work ceased after building several miles of graded roadbed, two large tunnels and several bridge abutments. The incomplete Paradise Creek tunnel, a remnant of that attempt, is located not far from this watershed. Finally in 1916, the Southern Pacific Company again took the lead and completed a route between the Willamette Valley and the coast. However, this route followed the Siuslaw River, bypassing the Umpqua River.

Today, few prehistoric archeological sites are documented in or near the watershed. One prehistoric site has been recorded on a river terrace just downstream from the watershed. An additional site has been recorded on public land within the watershed. The paucity of documented sites is more a result of land ownership patterns than a reflection of sparse prehistoric use of the area. That is, the lands most suitable for prehistoric occupation were homesteaded early on, passed into private ownership, and have not been inventoried for archaeological sites. However, collections from private lands in the watershed indicate a rich prehistoric occupation. Whatever prehistoric archeological resources do still exist in this watershed (whether we have knowledge of them or not) are finite and non-renewable, and over time it is expected that they will continue to be destroyed both by natural and human-caused land alterations.

Reported 19th and early 20th century historic resources include an abandoned coal mine, several farmsteads, the Gottlieb-Mehl mill site, and portions of two trails and an early wagon road. Late 1940's and 1950's logging remains in the near future will reach the minimum age (50 years old) to be considered for inclusion on the National Register of Historic Places. Materials and features dating from this period should be identified and monitored during future ground-disturbing activities.

Comparing conditions of the past and present, one element becomes apparent. Awareness of the cumulative effects of past land management practices is being reflected in the political and legislative arena. Timber management continues to have national significance. It also has great impact on ecosystems. Agricultural management and impacts are believed to have mostly local and regional influence.

No major changes in the rural atmosphere of this watershed are indicated. The population has remained relatively stable in this watershed, and is expected to remain so in the next half century.

Historical BLM Harvest Volumes

Table 2-1

<u>Year</u>	<u>Acres</u>	<u>Ave. vol/ acre</u>	<u>Volume (mbf)</u>
1954	167	45.5	7598.5
1955	183	45.5	8326.5
1956	48	45.5	2184.0
1957	155	45.5	7052.5
1958	130	45.5	5915.0
1959	252	45.5	11466.0
1960	112	45.5	5096.0
1961	189	45.5	8599.5
1962	85	45.5	3867.5
1963	0	45.5	0.0
1964	68	45.5	3094.0
1965	168	45.5	7644.0
1966	159	45.5	7234.5
1967	103	45.5	4686.5
1968	35	45.5	1592.5
1969	50	45.5	2275.0
1970	146	45.5	6643.0
1971	0	45.5	0.0
1972	296	45.5	13468.0
1973	71	45.5	3230.5
1974	147	45.5	6688.5
1975	278	45.5	12649.0
1976	328	45.5	14924.0
1977	115	45.5	5232.5
1978	47		1835.5
1979	104		4859.9
1980	106		4603.2
1981	243		11947.5
1982	0		0.0
1983	19		1035.5
1984	136		7185.0
1985	90		5209.6
1986	128		5663.2
1987	275		12036.2
1988	475		21252.1
1989	32		1100.8
1990	127		4610.1
1991	0		0.0
1992	0		0.0
1993	0		0.0
1994	0		0.0
1995	0		0.0
1996	76		3302.1
<u>1997</u>	<u>97</u>		<u>4322.0</u>

Average 1954-1997

5418.9

T21S

Elkton-Umpqua WAU**Recreation Sites
& Major Roads**

T22S

**MEHL
CREEK**

T23S

**MCGEE
CREEK**

T24S

**EAGLEVIEW
REC SITE**Myrtle
Island**YELLOW
CREEK****TYEE
REC SITE****Hwy 138
LOST
CANYON****LEGEND**

- ✱ BLM Recreation Sites
- Subwatersheds
- Text Section
- Section Lines (Lli)
- ▤ Major Roads
- ▤ Streams (3+ Order)
- ▤ Umpqua River
- ▤ BLM Ownership

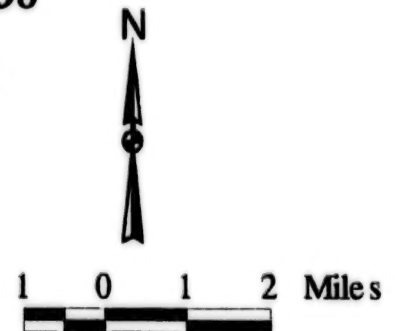
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VEGETATION

A. Key Questions for Elkton-Umpqua WAU

- What was the past and what is the current array of vegetation types?
- What is the most prominent influence (non-man related) that has changed vegetation in the past? (eg. lightning strike caused catastrophic fire, wind storms, etc.)
- How does thinning effect diameter and crown development?
- When is thinning the best option in young managed stands?
- In which areas will noxious weed treatment most benefit native vegetation and wildlife?
- *Can wood volume be harvested within Riparian Reserves while simultaneously managing for other resource objectives? If so how would that occur?

*This last key question will be further addressed in the Aquatics portion of this watershed analysis.

B. Historical and Current Vegetation Maps

In order to compare past and present vegetative conditions found in the Elkton-Umpqua WAU, a 1936 vegetative type map was used to compare with 1992 satellite imagery that was reclassified into vegetative age classes and diameters across all lands in Elkton-Umpqua WAU (Figure 3-1, Tables 3-1 through 3-4, Charts 3-1 through 3-4). These maps give descriptions of forest types in Douglas County in terms of diameter class and species and show general changes in vegetative patterns. Although the scale of these maps is large and detail lacking, the information can be used with caution to compare changing vegetative conditions. The diameter classes from these type maps were correlated to seral age classes. Thus the diameter class of 0 to 6 inches was correlated to forest stands that are between 0 and 30 years of age, 6 to 20 inches with 30 to 80 years (Mid Seral) and greater than 20 inches were correlated to forest stands of greater than 80 years (Late Seral). Conditions described from the 1936 map were used to approximate historical conditions found in the WAU. The 'natural range of conditions' for vegetation can only be approximated since no vegetative type maps exist for this WAU prior to 1936.

1. 1936 Vegetation Map

This information and data came from a map of **Forest Resources of the Douglas Fire Region**. This map was digitized, attributed and included in the districts GIS system. Information came from a survey of the Douglas Fir Region conducted by H.J. Andrews and R.W. Cowlin. Little direct information is available but it was started in the late 1920's and completed in the mid 1930's. The map was produced in 1936 and results published in 1940 (USDA Miscellaneous Publication 389).

Since the Oregon and California Revested Grant Lands were outside National Forest Lands, these lands were surveyed in a different way. The next paragraph is found on Page 147 of the referenced publication - *Field Procedures*.

"Each mapper visited the county seat and created a base map of roads and trails. The mapper then familiarized himself with the county road system and began mapping. They would map as much as possible from roads and trails. Picking points that would give the best view of the country and using as a control the roads, streams and other features on the base map and the type areas already entered on the vellum map from office records, he oriented himself with a compass and mapped all that could be seen. Each type area was viewed from several vantage points to determine its exterior boundaries. In this region of dense cover and irregular, often rugged topography, once under forest cover it is difficult to see out and great care was necessary to avoid overlooking any small farms, pasture lands, burns or small second growth areas."

2. 1992 Vegetation Map

This map, for total, BLM and Non-BLM Lands, is based on a reclassified 1992 Landsat Thematic Imagery. Landsat Imagery data has a pixel size of 30 by 30 meters. Features on the ground less than 30 meters in size would probably not be identified on the imagery. During the rectification process, the pixel size was resampled from 30 meters to 25 meters.

Vegetation maps derived from satellite data strive to attain an overall accuracy of 80%. Some land cover types having unique energy reflectance properties are easier to identify using image classification techniques, and therefore are classified more accurately. Other land cover types that reflect similar amounts of energy can bring about misclassification. Examples of this include: Water and shadow, agriculture fields and recent clearcuts, dense brush and small hardwood stands.

To perform supervised classification there is a need for training data. This imagery utilized two (2) sources of data for training: the 1985 BLM 5-point inventory data and aerial photo interpreted polygons. The 5-point inventory data has a number of disadvantages:

- it falls onto BLM Land
- it was created in 1985
- it is biased toward conifer stands

Using aerial photos can be inconsistent when numerous individuals are performing the interpretations. Aerial photo coverage is for BLM land only.

(Source: Nighbert, Jeff; Julie O'Neil and Allen Byrd 1997 **Western Oregon Digital Image Project: WODIP Guide Book**, Bureau of and Management; Portland, OR.)

B. Fire History

In future iterations of watershed analysis some inferences may be made from other data to determine historical vegetative types. These data sources may include timber cruise information of past harvest units on diameters of older, residual trees, amounts and sizes of down wood and understory development. Descriptions of soil types and aspects also could give clues to vegetation history. This information helps to create an historical view of the types of processes working in various portions of the watershed and the resulting timber and vegetation types. Fire history can also help give a picture of the processes that have effected the vegetation types.

An average fire return interval (FRI) for all Oregon Douglas-fir type forests over the past few centuries has been estimated at 150 years (Agee, 1993). Agee states "...fire frequency estimates were made using a variety of methods and periods and probably do not reflect the actual fire record of any single decade or century of the current millennium". Working at the H.J. Andrews forest in 1987 Dr. Teensma calculated a mean fire return interval for stand replacement fires of 130-150 years.

A regional average fire-return interval for the Douglas-fir zone has been estimated at 230 years (Fahnestock and Agee 1983). The fire-cycle model used for this analysis was characterized by significant variability over time and space. The notion that an "average" or "regular" fire return interval can be calculated in Coast Range forests is unrealistic. Agee believes "Episodic" is a better descriptor of fires occurring in our area.

Stand replacing fires in the moist, coastal forests north of Roseburg can range from 100 to more than 500 years. Much of the WAU is still influenced by the moist, marine climate typical of coast forests. However, in the forest lands east towards the Cascade Range, natural fire is more frequent. The average stand replacement FRI for the Elkton-Umpqua WAU is estimated at 200 years or more.

A fire regime is a generalized description of the role fire plays in an ecosystem. One of several systems for describing fire regimes uses combinations of frequency and intensity to describe six fire regimes (Agee, 1981a). For this analysis, the WAU is considered a combination of 2 of Agee's fire regimes.

Fire regime 5: Long return interval crown fires and severe surface fires in combinations (100-300 year return intervals).

Fire regime 6: Very long return interval crown fires and severe surface fires in combination (over 300 year return intervals).

A second system of fire regime classification is based on the effects of fires on dominant vegetation, from low to high fire severity (Agee, 1990). With this system, the WAU would be classified as a high severity fire regime. High severity fire regimes can have 70% or more of their basal area removed. Douglas-fir, the dominant tree species in this area has the unique ability to resist damage by fire because of the bark thickness on older trees. As a result, many existing natural stands appear as a mosaic or patch work of areas of old growth, scattered mature trees and younger stands of even-aged conifers. On any site, all levels of fire severity will be present over large scales of space and time, but characteristically in different proportions.

Specific fire history data for this WAU's has not been collected. Methods for determining fire history are described by Agee in Fire Ecology of Pacific Northwest Forests. Sampling of fire scar data is considered a good means of establishing fire history, but they are not commonly present in high severity fire regimes. In some cases stand age class determination can accurately establish the dates of past fires. Due to the checker-board ownership pattern and the extensive logging in this area, this approach is not feasible. Time required and costs of collecting data from fire scars or age class information to create a fire history of this WAU can not be justified at this time. By interpreting historical records and maps and with a professional knowledge of fire behavior and fire effects, general assumptions will be made and used as the basis of this analysis.

C. 1914 Oregon State Forest Type Map

In 1914, Oregon State forester, F. A. Elliott, commissioned development of a map of the state. The extent of prehistoric and historic forest fires is shown, as are commercial timber stands, burned areas successfully reforested and burned areas not reforested. This map has been digitized on computer and the attached map shows how the Elk-Umpqua WAU was classified in 1914. Hypothetical descriptions of the vegetation are provided for these areas based on my knowledge of fire behavior, fire effects, forestry, and history (Figure 3-2).

This WAU is dominated by private lands contiguous to the Main Umpqua River, over 67% is in this classification. This private land is made up of small ranches, rural homesites, with the majority in industrial forest ownership. BLM administered lands make up about 33% of the WAU. These lands generally are located in the foothills above the river bottom lands. According to the 1914 map the vast majority of BLM lands were classified as merchantable timber. Much of the private land, specifically in the lower valley bottom areas was determined to be non-timbered lands and brush. However, private lands on the upper slopes and ridges were timbered.

The 1914 map makes no distinction between mature timber (old growth) and younger stands of merchantable size. It is highly unlikely that the area classified as merchantable timber was a continuous block of "old growth" timber. Man caused and lightning caused fire (the result is the same) has likely been the dominant natural disturbance in this area for hundreds, perhaps thousands of years before white settlement. It is likely that most of the timber stands present in the WAU in 1914 originated from stand replacement fires and to a lesser degree, wind related disturbances.

The 1914 map labeled about 1800 acres as "Burned Areas - Restocking". Most of this land was in private holdings adjacent to the river. Likely these fires were of lower intensity, leaving many mature trees to "seed" the burns. The area classified as "Burned Areas - Not Re-stocking" is considered to have been caused by stand replacement fires that occurred at least 10-15 years earlier. Approximately 2% (2100 acres) of the WAU was determined to be in this classification. Many large fires occurred around the turn of the century in the Northwest. These burned areas were probably the result of severe surface and crown fires. "Early season crown fires, or crown scorch fires in poor seed years, may be associated with a lack of early regeneration after a fire." (Agee 1993). In coast range forests, tree recruitment or reestablishment can take 50 years or more. Because of this, the fire that caused these burns may have occurred in the 1870's. By 1936 nearly all these acres were classified as timbered.

The area classified as "Brush and Non-Timber Areas" occupied much of the private land holdings in and around the river bottom lands. These areas may have resulted from earlier stand replacement fires that consumed any existing tree canopy. More likely, repeated Indian and settler burns may have eventually consumed the majority of conifers in these foothill areas. The native Indians used fire to improve forage for game. Grasslands were burned in the late summer. It must be assumed that some of these fires burned more than grasslands, perhaps becoming stand replacement fires in

the timbered areas higher up on the ridges. Repeated burnings probably contributed to the large amount of "Brush and Non-Timber Areas" shown on the 1914 map. Fires are known to have burned all summer until the fall rains extinguished them. "In all the low valleys of the Umpqua there was very little undergrowth, the annual fires set by the Indians preventing young growth of timber". (George Riddle, 1851).

Perhaps there was no a canopy to burn, the area may have always been brush component. Regardless of the previous vegetation, fires have burned here with high enough intensity, leaving no seed source for conifer re-establishment. Brush sprouted from below ground adventitious buds and completely occupied the site. More recently, with increased fire suppression, many of these areas have become reforested either naturally, or by conversion of brush to conifer stands.

D. Additional Fire History and Fire Starts Since 1967

The analysis area is located in the low elevation hills which drain into nearby Elk Creek and the Main Umpqua River. This area's landscape has been influenced by large fires in the past, and most recently by road-building and logging. The adjacent private "bottom lands" are mostly pastured now. Natural fire and escaped Indian/settler burns have impacted the adjacent BLM timber over time. Douglas County Surveyor notes from 1855-1871 speak of large fires in Township 22-7. In the SW portion "Timber principally fir considerable of which is burnt". Timber lands in sections 6 through 11 are regarded as burnt and 3rd rate. In 1871 a surveyor noted live fire in sections 6 & 7 stating "...everything on fire or burned up about here, fire raging furiously. Timber good before the fire, worthless since".

Records of fire starts in the Watershed from 1967 thru 1991 are available on a database created by the DFPA (Figure 3-3). These records indicate that nearly 100 fires occurred in the WAU over this period of time. The largest fire was caused by debris burning on private ground in September 1970, and it was size class D (100-300 ac.). Only 14 of the fires (15%) were on BLM lands. The majority of fires on BLM lands were lightning cause, the largest being 5 acres.. Because of rapid initial attack by the DFPA over 90% of these fires were less than 1 acre in size.

E. 1936 Vegetation Age Class Distribution

As shown on Figure 3-3 the areas of more frequent lightning strikes may be an indicator of the areas having a greater frequency of fire in past history. It appears that a greater proportion of lightning strikes occurred in the Yellow Creek subwatershed. This may correlate with the forest vegetation types on the 1936 Vegetation Age Classes in Yellow Creek (Figure 3-1) which indicate Mid-Seral type stands, typically from 30 to 80 years of age. The Mid-Seral type stands may show that there was a stand replacement fire in Yellow Creek between 1856 and 1906. This does not necessarily correlate with the 1914 Fire Map (Figure 3-2) which may be due to mapping error. Tables 3-1 through 3-4, and Charts 3-1 through 3-4 (pages 3-13 through 3-18) show the proportion of vegetation types both historically (1936) and currently (1992) on BLM and Private lands respectively.

F. Current Vegetation Age Class Distribution

The following write-up on vegetation is based on existing forest inventory records, the 1936 USFS type map, 1992 satellite imagery, and surveys of natural and managed stands on BLM land. The Organon (Hann, 1995) growth model is used to predict future stand attributes under different management scenarios.

1. Processes: Stand Development

The dominant physical process responsible for changes in forest type, with the exception of timber harvest, is fire. Fire is the major disturbance event that leads to regeneration of the Douglas-fir forest by removing the overstory shade and creating a bare mineral seed bed. If not for naturally occurring stand replacing fires this forest would consist predominantly of shade tolerant conifers. The frequency and intensity of fire is variable and dependant on landform and climate. In general, low intensity surface fires are more prevalent and create small, non-contiguous openings. Large, stand replacing fires are much more infrequent, with intervals estimated at 200 to 500 years. The result is a mosaic of single and multi cohort stands across the landscape.

Following a major fire event the openings created are rapidly reestablished with the plants that existed prior to the

disturbance. Roots and seeds that survive the fire in the soil sprout and germinate soon after. Adjacent plants shed seed on these areas, and the process of regeneration begins. The progression is not so much a well defined succession of new plants as it is a reoccurrence of the previously established plants. The length of time required for Douglas-fir to reestablish and dominate is variable and dependent on seed source and the degree to which the site is occupied by other plants. Because of this the age of trees in natural stands is not even, but rather a range that may span 200 or more years. The term even-aged does not accurately define most natural stands. A better term may be *single cohort* and is defined as all the trees that have resulted after a single disturbance event (Oliver et. al. 1990). A *multi-cohort* stand is one where minor disturbance events have created smaller openings in a patch like nature and younger cohorts exist interspersed with much older cohorts.

Recently forest development has replaced fire as the dominant disturbance event. Logging, road building and planting has converted much of the old natural forest into young Douglas-fir plantations. To some extent clearcutting and burning mimics a major disturbance event, but there are some major differences. Some of the more obvious differences include the removal of large trees, the creation of young stands that are much more uniform and even-aged, and the lack of large snags, large defective trees, and coarse woody debris. In time this practice would likely result in the loss of stand structures associated with old growth forests.

Other disturbance events that add to plant diversity include landslides and other soil movements, storms, disease, insects, and climatic change. There is no evidence to suggest that any of these events are responsible for the creation of large openings, or major change in plant communities in recent time. However, the potential for large scale disturbance and change in plant communities as a result of any of these events certainly exists.

2. Stand Structure Classification and Seral Stage

Structural and compositional characteristics will be used to define three distinct seral stages; early, mid and late. Each of these seral stages contain characteristic structure that can be defined. A comparison of the percent of area in each of the seral stages between the current and reference condition is then possible.

Early Seral is the time when the available growing space is reoccupied and shared by many species of plants. These early plants are sometimes referred to as pioneers, and may be short or long lived. In plantations, these early plants compete with trees and are often removed as part of management. In natural stands, conifers become established and eventually expand to exclude many of the early plants so that eventually competition is primarily between trees.

Mid seral begins when trees and/or other plants have captured all of the available growing space. The area is fully occupied and new plants will normally not invade unless there is further disturbance. The dominant plants are competing with each other for the available growing space, often forming a continuous closed canopy that allows very little light to reach the soil surface. Surface vegetation and plants that can not maintain their position in the canopy die. Compositional and structural diversity is more limited than in the early and late stages. Growing space becomes available slowly as plants die from competition, and growth rates are slow.

Stand differentiation often begins in the mid seral stage of development.

In natural stands difference in the age, size, and genetic potential of trees, and the differences in microsite and the abundance and arrangement of other plants, leads towards stand differentiation.

In managed plantations trees are more uniform in size, age, spacing, and genetic potential. Other plants are often excluded as part of management. It is more likely that the trees in these stands will all grow up together and reach a condition where competition between trees results in substantially reduced growth. It probably takes much more time for stands in this condition to differentiate.

Late seral is defined as having the following characteristics:

- Deep multiple canopy layers: This characteristic may not occur in nature on southerly aspects because of the frequency of fire. Typically two or more canopy layers exist until the younger cohorts reach heights equal to the older residual conifers.

- Diverse tree size, form and condition; Trees are not evenly spaced and may exist in clumps, and tree size and form are affected by this variable distribution and density. Trees that are open grown typically have large diameter stems and full crowns. Tall, cylindrical stems with narrow crowns are found when trees grow close together. Large old conifers are present. Many of the oldest conifers are fire scarred and hollow, have broken tops, and contain heart and butt rots.

- Canopy gaps and natural openings; Late successional forests contain openings. The degree to which a stand is open, and the size and spatial arrangement of openings depends on the processes that create them. Stand age, frequency and intensity of fire, disease, insects, wind, and soil movement all have an effect.

- Large snags in various stages of decay; Competition, fire, insects and disease are primarily responsible for the creation of large snags. This is probably a highly variable characteristic. Some large snags are present in late successional forests even when fires occur frequently. There are probably fewer large snags on aspects prone to frequent, high intensity fires.

- Coarse woody debris; The processes that create snags also create coarse woody debris. The amount that exists may depend on the frequency and intensity of fire.

- Species diversity; Countless species exist in late seral forests, many of which are difficult to inventory and describe. Large conifers including Douglas-fir, grand fir, incense-cedar, western red cedar and western hemlock are present in the oldest stands. Hardwoods and shrubs are common. The late seral stage includes areas of early and mid seral development interspersed.

3. Arrangement of Stand Structures

The arrangement of natural stands is dependent on process, and results in a mosaic of single and multi-cohort stands across the landscape. Private lands are interspersed with federal lands. Most of the private lands are managed for agricultural purposes or as tree farms to produce wood fiber on short (estimated at 50 years) rotations. Currently on BLM lands, natural stands are interspersed with younger, managed plantations. Tables 3-2 and 3-4 (page 3-13, 3-14) shows the 1992 vegetation types based from satellite imagery.

Table 3-5 shows the existing age class distribution on federal land within the watershed and acres within the age class that have been precommercially thinned and/or fertilized. Data is from the forest operations inventory.

Table 3-5

Age Class	Acres	Pct Acres	Fert Acres
0 - 9 years	1,514		
10 - 19 years	2,275	1,245	472
20 - 29 years	2,024	717	526
30 - 39 years	4,325	1,761	1,107
40 - 49 years	1,087	153	94
50 - 59 years	591		
60 - 69 years	277		
70 - 79 years	316		
80 + years	21,384		
Total	33,793	3,876	2,199

Typically an area is planted with between 450 and 650 seedlings per acre after regeneration harvest. Plantations are maintained to assure survival of at least 150 well spaced conifers per acres. Precommercial thinning is usually required at about age 15 year.

A sample of 10 plantations between 5 and 9 years of age and one replication from a 15 year progeny site were used to calibrate the SYSTUM-1 young stand growth model (Ritchie, 1993). The sample plantations and the progeny site were well maintained to assure seeding survival, but hardwoods and shrubs are still present. This data was used with SYSTUM 1 to generate average stand conditions at age 15 years. Table 3-6 represents an average condition of all stands sampled as output from SYSTUM-1.

Table 3-6

Average Stand Conditions at 15 years with and without PCT

Species	TPA without PCT	TPA with PCT
DF	598	220
Other Conifer	75	27
Hardwood	7	3
TOTAL	680	250

The stand conditions at age 15 are input to the Organon model. The model is used to project stand conditions at age 30, 40, 50 and 60 years with and without precommercial thinning.

Table 3-7

Existing Stand Conditions without PCT.

Age	TPA ¹	BA ²	VOL ³	QMD ⁴	RD ⁵	HT ⁶	CC ⁷	CR ⁸
30	580	175	8.5	7.4	64	68	100	52
40	456	213	21.0	9.3	70	92	100	44
50	376	243	36.0	10.9	74	113	100	40
60	318	268	51.5	12.4	76	132	100	36

¹ Trees per acre.

² Basal area per acre in square feet; the total of the cross sectional area in trees including bark and measured at 4.5' above the ground. Used to explain the area occupied by trees.

³ Volume per acre in thousand board feet.

⁴ Quadratic mean diameter; the diameter of the tree with mean basal area.

⁵ Relative density (Curtis); ba/ac divided by the square root of the QMD. Used to define the upper (55) and lower (35) thinning limits. Above 55 and competitive stress causes tree mortality, reduced live crowns, weak stems and roots. Below 35 and the area is not fully occupied with tree species.

⁶ Height; total height of the dominant trees in feet.

⁷ Crown Closure: the percent of overstory canopy that is closed. Can exceed 100% when limbs are intertwined.

⁸ Crown ratio; the ration of live crown to total tree height as a percent.

Table 3-8

Existing Stand Conditions with PCT.

Age	TPA	BA	VOL	QMD	RD	HT	CC	CR
30	248	119	6.5	9.4	39	60	110	80
40	246	203	21.1	12.3	58	84	115	61
50	209	238	36.5	14.4	63	107	100	51
60	185	264	54.0	16.2	65	126	100	45

What is obvious and should come as no surprise is that diameters and crowns are larger with thinning. The difference in the TPA from 30 to 60 years age is mortality due to competition between trees.

The opportunity to commercially thin both stands exists at about age 40. Either stand would probably benefit from thinning at an earlier age, but in order for the thinning to be commercial there needs to be enough volume. Commercial thinnings are usually planned to remove about 40 percent of the basal area per acre, removing the smallest trees first. This was done using the Organon model and stands were projected to age 80.

Table 3-9

Existing Stand Conditions at age 80.

Without Commercial Thinning				With Commercial Thinning			
TPA	BA	QMD	CR	TPA	BA	QMD	CR
193	330	17.7	30	97	268	22.5	41

The model predicts smaller diameters and live crowns without commercial thinning. Again, there is a reduction in the amount of dead wood due to competition between trees with thinning. However, after age 80 the trees that die are much larger and might make good snags and coarse woody debris.

Table 3-10 is based on stand exam data from managed and natural stands. It can be compared to the growth model projections.

Table 3-10

Type	Age	TPA	BA	QMD	Vol	RD	CC	CR
Unmanaged	50	176	184	13.8	34.5	50	76	47
Managed, No PCT	37	713	237	7.8	18.0	85	100	33
Managed, w/ PCT	37	242	215	12.8	26.0	60	87	47

A regression analysis was done using continuous forest inventory plot data to predict diameter by age. The best r squared was obtained when only plots between the 50 and 150 year age classes with < 50% hardwoods and > 60% BA in trees > 7.0" diameter were used. The resulting curve predicts a 10 inch diameter at age 30 years. R squared is .32 (32% of the variation is explained by the equation). This is not statistically robust, but does come very close to the modeled and the measured diameter at age 30.

H. Special Status Plants

There are many plant species of concern that are known or suspected to occur in the Elkton-Umpqua Watershed. Species of concern include Threatened, Endangered, or Sensitive species also (known as special status plants) as listed identified by the Oregon Natural Heritage Program, noxious weeds as identified by the Oregon Department of Agriculture, and vascular and nonvascular plants that are listed in the Roseburg BLM Record of Decision (Special Attention Species). There are no designated areas for protection of unique habitat to benefit plants, but there are three Areas of Critical Environmental Concern (ACEC) set aside for eagles which contain suitable habitat for some special status plants (SSP) (Figure 3-5).

1. Special Status Plants

No comprehensive watershed or subwatershed surveys have been conducted. All surveys have been associated with ground disturbing projects. Only two special status plants (SSP) have been found within the Elkton-Umpqua watershed; *Dichelostema ida-maia* (Fire Cracker Plant) and *Phacelia verna* (Umpqua Phacelia). There are four recorded sites of *D. ida-maia* found in woods and meadows. There is only one site of *P. verna*, on a rock out crop, in the watershed although numerous sites have been found within five miles in adjacent watersheds.

Typically many of the SSP that could or do occur in this watershed prefer dry or vernal areas with sparse canopy cover or thin soils and rock out crops that do not support coniferous trees (Table 3-11). The Western Oregon Digital Image Project has identified 138 acres of barrens (rock outcrops/thin soils). None of them occur on BLM land in this watershed.

Additional potential habitat has been identified by aerial photograph interpretation and in the Forest Operations Inventory (Table 3-12). It is suspected that additional undiscovered sites of SSPs and potential habitat exist within the watershed.

There is an *Eucephalis vialis* site on county land close to Myrtle Island Research Natural Area (RNA) approximately one mile west of the study area. *E. vialis* grows in a open mixed evergreen/hardwood forests at low to middle elevation in partial sun. It is a federally proposed species for listing as Endangered and is listed in the Record of Decision Table H-2 as survey and manage strategy one and two species. There is a strong possibility that this species occurs in the Elkton-Umpqua watershed.

2. Special Attention Species

There are 358 plant species listed in Appendix H of the Roseburg District ROD. While some of these species are well known and quite common many have not been observed in the Pacific Northwest more than a few times. *Tritomaria exsectiformis* has only been recorded at a few sites from northern Washington and central Oregon. Coastal species have been observed hundreds of miles inland far from any coastal influence. Because of their rarity little is known about the ecological parameters in which they can grow therefore only the broadest of ecological screens can be used to determine potential habitat within a given area. Because of the lack of information about many of the special attention species I believe that the Elkton-Umpqua watershed is potential habitat for a majority of the species listed in Appendix H. Table 3-12 lists special attention species that are known to occur within the Elkton-Umpqua watershed or adjacent watersheds.

3. Noxious Weeds

This watershed is heavily infested with noxious weeds. The most abundant and noticeable is *Cytisus scoparius* (Scotch broom) which grows along many roads and sometimes completely blocks them. At this point infested roads need to be brushed and sprayed with herbicide or the plants pulled to control the spread, since vehicles, logging, and construction equipment are responsible for dispersing most of the noxious weed seed. Infestations are also present at rock stockpiles, landings, quarries, and clearcuts. In fact, many species of noxious weeds occur in these habitats because they are mineral soil colonizers, require lots of sunlight, and are contaminants in seed mixes.

Lythrum salicaria (Purple loosestrife) is found along waterways, wet meadows and anywhere it's roots can reach the

water table. It can easily choke backwaters and marshy areas reducing habitat for fish, aquatic and semiaquatic plants. Purple loosestrife has even been known suppress or displace previously established shrubs. This plant poses a problem for eradication, since it exists along waterways where herbicide application may be in conflict with water conservation strategies. Biological and mechanical controls are labor intensive which can be impractical. It has been found upstream in Golden Bar ACEC and quite possibly exists in Brad's Creek, Martin Creek ACECs, and the few other pieces of river front lands that the BLM controls. Small waterways flowing through BLM lands are at risk of becoming infested also. *Senecio jacobaea* (tansy ragwort), *Cirsium vulgare* (Bull thistle), *Cirsium arvense* (Canada thistle), *Hypericum perforatum* (St. John's wort) are all found throughout the watershed.

Preventing the establishment and spread of new noxious weed populations is the best method of protecting our public lands. Many weeds are mineral soil colonizers hence disturbed areas are most susceptible to invasion. Timber harvest and road building provide most of the primary habitat for weeds. Heavily grazed areas are also an area of concern due to the reduction of native plant cover. Seeds are known to become lodged between tire treads and vegetative material sticks to cracks underneath the vehicle often traveling hundreds of miles before dropping off to infect a new area. Cleaning logging and construction equipment before a project begins and requiring certified weed free seed and mulch (hay) for revegetation projects will prevent the weed from being introduced to a site.

When new noxious weed sites are discovered they should be reported to the District Weed Specialist and a control plan should be developed and implemented. The methods will vary according to species of weed, size of infestation and location of infestation. Most sites will require a combination of methods: mechanical removal, herbicide application, biological controls, prescribed fire, and native plant revegetation.

Table 3-14 shows weeds that are suspected (S) or known (K) within Elkton-Umpqua WAU. It was compiled from the 1998 Oregon Department of Agriculture's Noxious Weed Policy and Classification System.

Table 3-1

ELKTON-UMPQUA 1936 VEGETATION TYPES

Vegetation Type	BLM Lands (Acres)	% of Total	Private Lands (Acres)	% of Total	Total Acres
Agricultural/Urban	951	1.1%	16983	18.8%	17934
Burned Areas	120	0.1%	468	0.5%	588
Early Seral	264	0.3%	1468	1.6%	1732
Mid Seral	4667	5.2%	7045	7.8%	11712
Late Seral	21848	24.2%	32900	36.5%	54748
No Data Available	1909	2.1%	1495	1.7%	3404
Sum Total	29759	33.0%	60359	67.0%	90118

Table 3-2

ELKTON-UMPQUA 1992 VEGETATION TYPES

Vegetation Type	BLM Lands (Acres)	% of Total	Private Lands (Acres)	% of Total	Total Acres
Agricultural/Urban	83	0.1%	14096	15.6%	14179
Early Seral	5493	6.1%	14940	16.6%	20433
Mid Seral	9752	10.8%	16766	18.6%	26518
Late Seral	14193	15.7%	11358	12.6%	25551
Hardwoods	417	0.5%	1471	1.6%	1888
Water	20	0.0%	1633	1.8%	1653
Sum Total	29958	33.2%	60264	66.8%	90222

Table 3-3

Elkton-Umpqua 1936 Vegetation Types by Subwatershed

	Agriculture Urban Lands		Burned Areas		Early Seral (0-30 Years)		Mid Seral (30-80 Years)		Late Seral (80+ Years)		No Data Available		Totals of WAU	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Elkton	2559	20.3%	381	3.0%	1323	10.5%	509	4.0%	7823	62.1%	0	0.0%	12595	14.0%
Lost Canyon	1471	11.4%	0	0.0%	0	0.0%	801	6.2%	10671	82.4%	0	0.0%	12943	14.4%
McGee Creek	2865	14.3%	0	0.0%	0	0.0%	1798	9.0%	15372	76.7%	0	0.0%	20035	22.2%
Mehl Creek	10787	34.8%	0	0.0%	409	1.3%	4640	15.0%	11766	37.9%	3404	11.0%	31006	34.4%
Yellow Creek	252	1.9%	207	1.5%	0	0.0%	3964	29.3%	9116	67.3%	0	0.0%	13539	15.0%
Total Elkton- Umpqua	17934	19.9%	588	0.7%	1732	1.9%	11712	13.0%	54748	60.8%	3404	3.8%	90118	100.0%

Table 3-4

Elkton-Umpqua 1992 Vegetation Types by Subwatershed

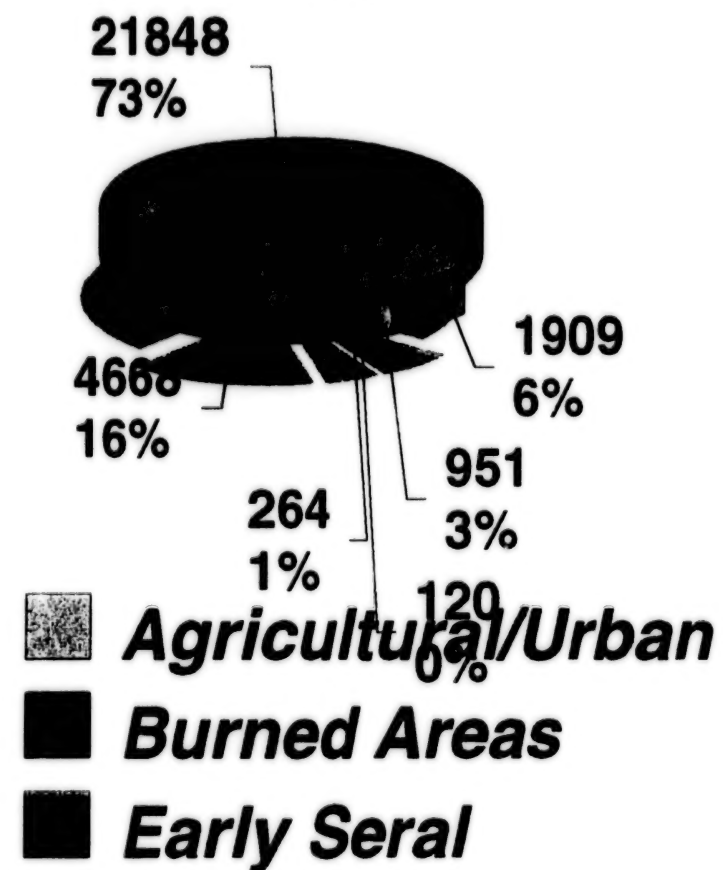
	Agriculture Urban Lands		Hardwoods		Early Seral (0-30 Years)		Mid Seral (30-80 Years)		Late Seral (80+ Years)		Water		Totals of WAU	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Elkton	1514	12.0%	358	2.8%	3196	25.4%	3661	29.1%	3866	30.7%	0	0.0%	12595	14.0%
Lost Canyon	568	4.4%	167	1.3%	2181	16.9%	5274	40.8%	4550	35.2%	201	1.6%	12941	14.3%
McGee Creek	3795	18.9%	336	1.7%	4970	24.8%	5330	26.6%	5110	25.5%	496	2.5%	20037	22.2%
Mehl Creek	8249	26.7%	885	2.9%	8209	26.6%	5725	18.5%	6884	22.3%	956	3.1%	30908	34.3%
Yellow Creek	53	0.4%	142	1.0%	1877	13.7%	6528	47.5%	5141	37.4%	0	0.0%	13741	15.2%
Total Elkton- Umpqua	14179	15.7%	1888	2.1%	20433	22.6%	26518	29.4%	25551	28.3%	1653	1.8%	90222	100.0%

Elkton-Umpqua Watershed

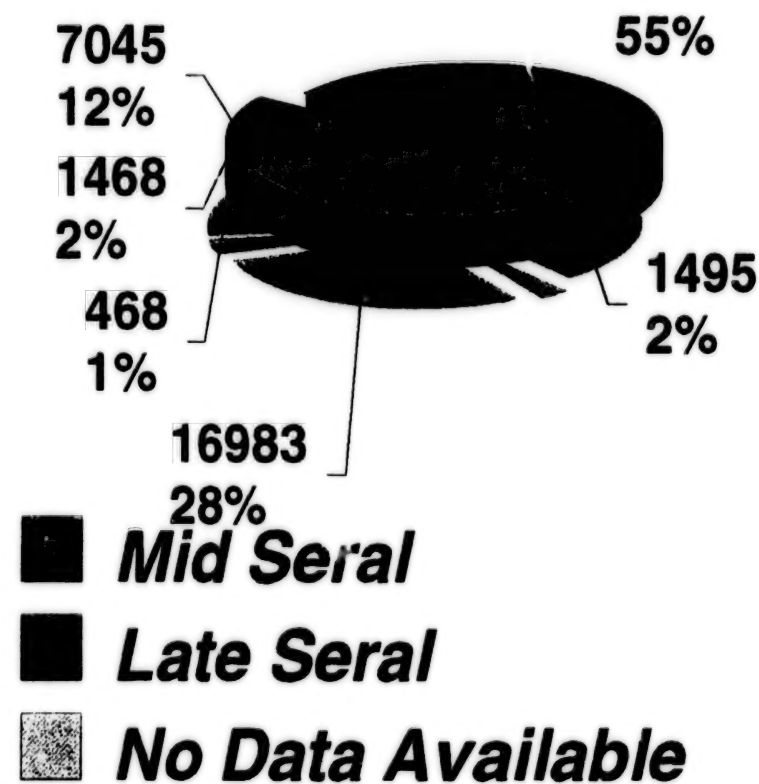
1936 Vegetation

Seral Stage - Chart 3-1

BLM Lands



Private Lands



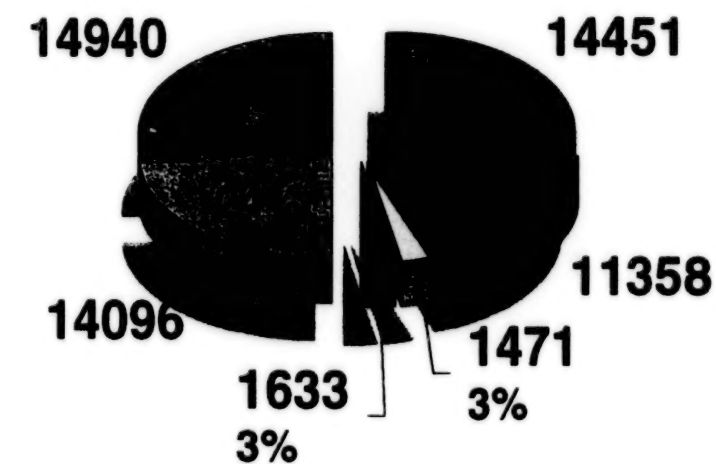
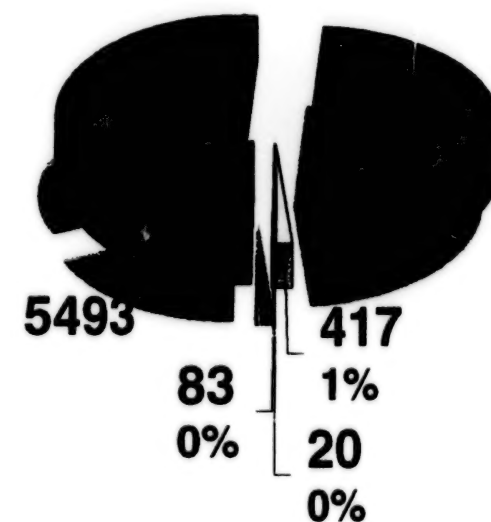
Elkton-Umpqua Watershed

1992 Vegetation Summary

Seral Stages - Chart 3-2

BLM Lands

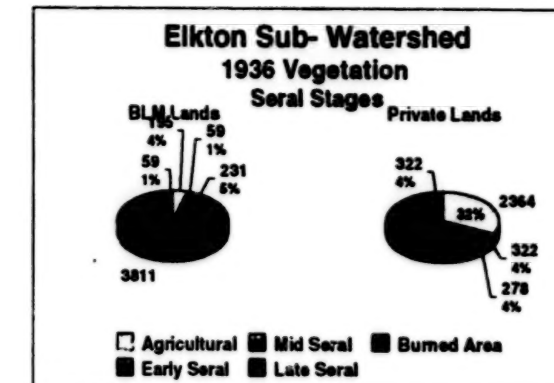
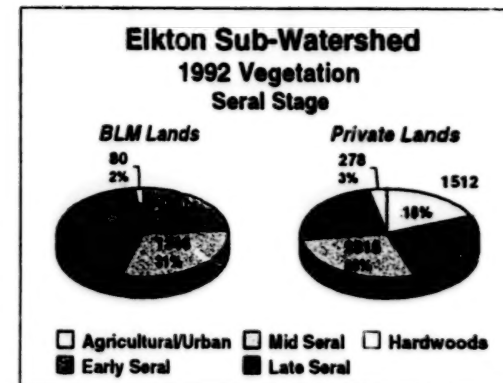
Private Lands



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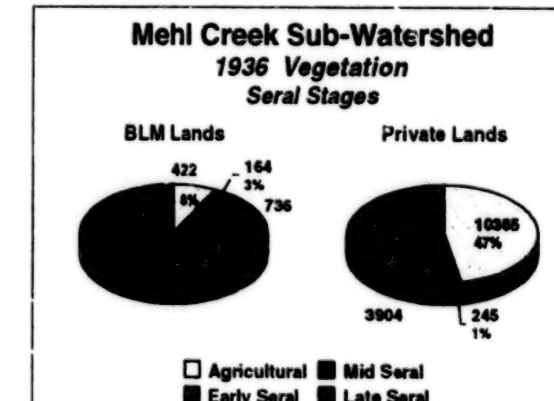
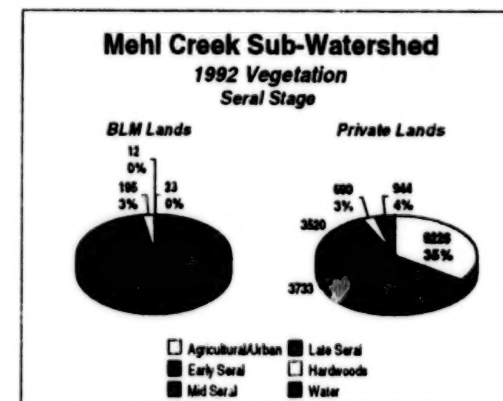
Elkton Sub Watershed

1992 Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	2	1512
Early Seral	1040	2156
Mid Seral	1346	2315
Late Seral	1927	1939
Hardwoods	80	278
Water		1
1936 Vegetation Seral Stage		
Agricultural	195	2364
Early Seral	59	322
Mid Seral	231	278
Late Seral	3811	4012
Burned Area	59	322



Mehl Creek Sub-Watershed

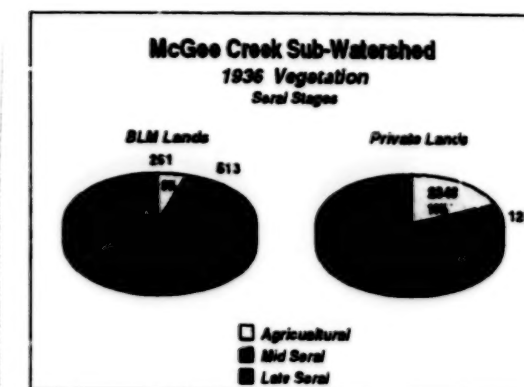
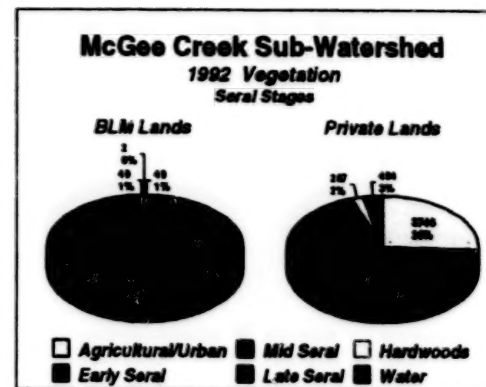
1992 Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	23	8226
Early Seral	1904	6305
Mid Seral	1992	3733
Late Seral	3364	3520
Hardwoods	195	690
Water	12	944
1936 Vegetation Seral Stage		
Agricultural	422	10365
Early Seral	164	245
Mid Seral	736	3904
Late Seral	4238	7508



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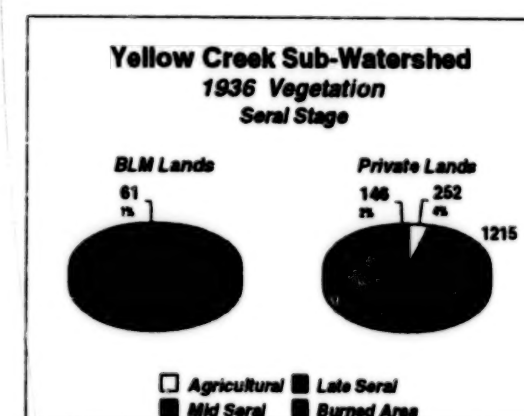
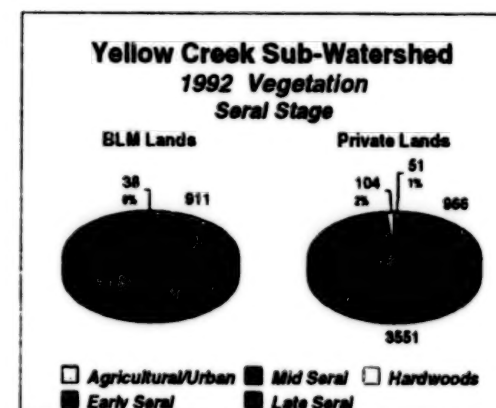
McGee Creek Sub-Watershed

1992 Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	49	3748
Early Seral	1111	3859
Mid Seral	1549	3781
Late Seral	2740	2370
Hardwoods	49	287
Water	2	494
1936 Vegetation Seral Stage		
Agricultural	281	3540
Mid Seral	513	1,425
Late Seral	4725	10647



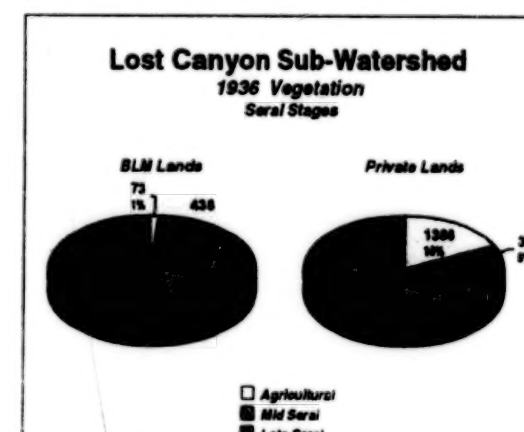
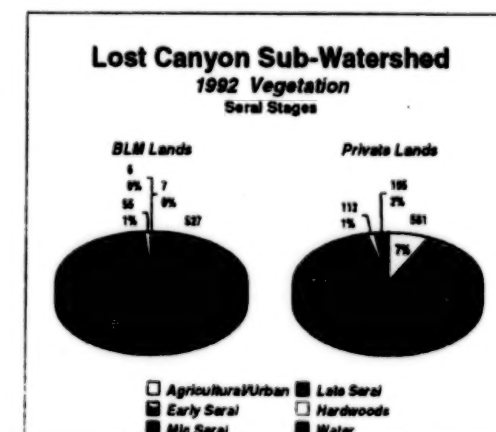
Yellow Creek Sub-Watershed

1992 Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	2	51
Early Seral	911	966
Mid Seral	2977	3551
Late Seral	3678	1463
Hardwoods	38	104
1936 Vegetation Seral Stage		
Agricultural	2749	252
Mid Seral	4597	1215
Late Seral	51	4519
Burned Area		146



Lost Canyon Sub-Watershed

1992 Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	7	581
Early Seral	527	1854
Mid Seral	1888	3386
Late Seral	2484	2068
Hardwoods	55	112
Water	6	195
1936 Vegetation Seral Stage		
Agricultural	73	1398
Mid Seral	438	363
Late Seral	4457	6214



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Figure 3-3

**1914 Fire Map
Elkton Umpqua Watershed**

T21S

T22S MEHL
CREEK

ELKTON

YELLOW
CREEK

T23S

MCGEE
CREEK

T24S

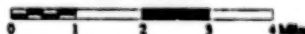
LOST
CANYON

T25S

R7W

R6W

Scale 1:100000



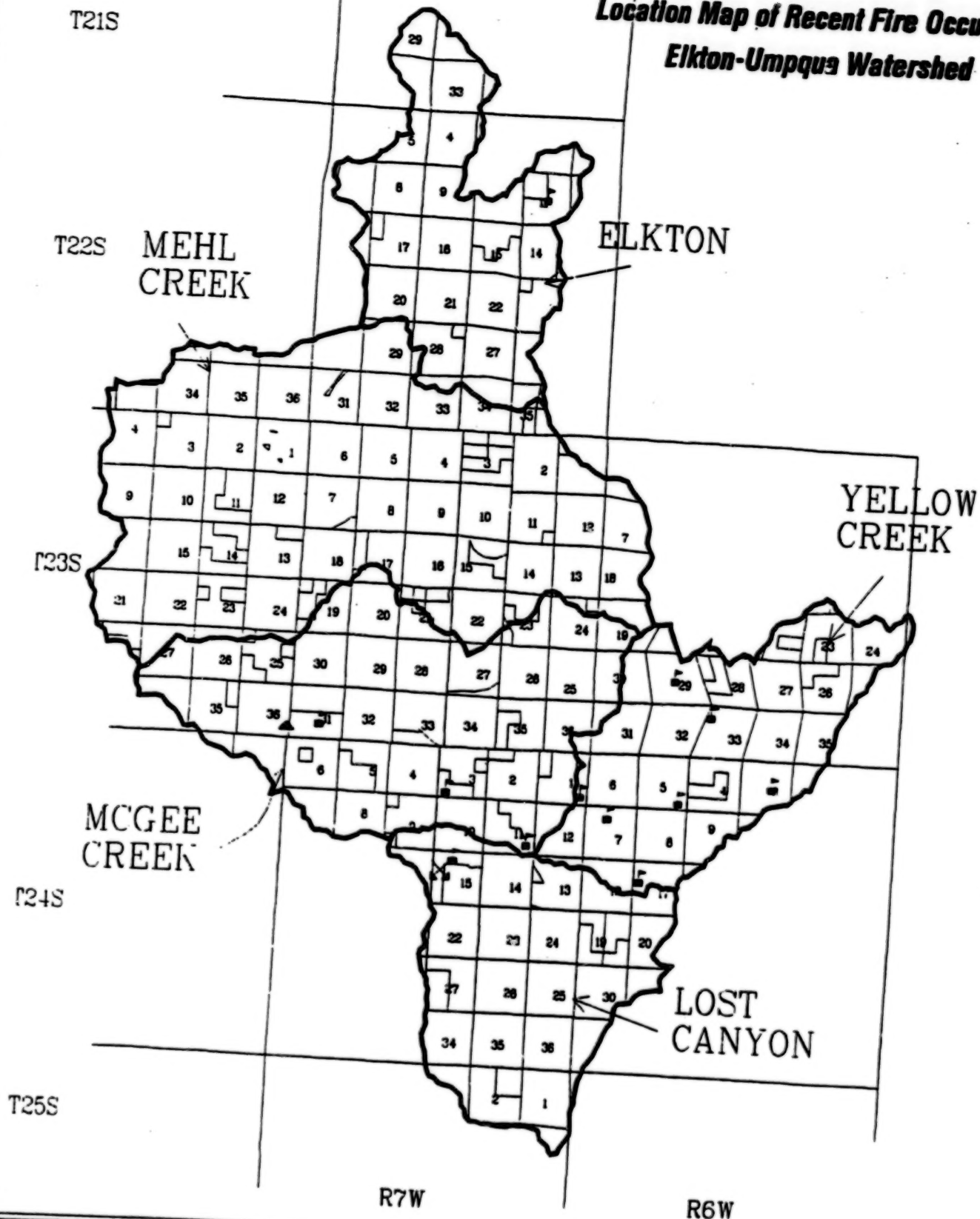
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

- Merchantable Timber
- Burned Areas - Restocking
- Burned Areas - Not Restocking
- Brush
- Non-Timber Areas



Figure 3-4

**Location Map of Recent Fire Occurance
Elkton-Umpqua Watershed**



Scale 1:180000
0 1 2 3 4 miles



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

Lightning Caused Fires
Fires caused by Blasting
Fires caused by Powerlines



T21S

Elkton-Umpqua WAU**Plant Species
of Concern**

T22S

**MEHL
CREEK**

T23S

**MC GEE
CREEK**

T24S

LEGEND

-  Subwatershed
-  Text
-  Section Lines (Li)
-  Major Roads
-  Streams (3+ Order)
-  Umpqua River
-  Areas with Species of Concern
-  BLM Ownership

R8W

R7W

R6W

Hwy 38**ELKTON**City
of Elkton

1 0 1 2 Miles

1:141277

**YELLOW
CREEK**Myrtle
Island**LOST
CANYON**

No warranty is made by the BLM
for use of the data for purposes
not intended by the BLM

Special status plants known or suspected of growing in the Elkton-Umpqua watershed.

Table 3-11

Species	Common name	Status*	Habitat	Probability
<i>Aster vialis</i>	wayside aster	SLT, SM1,2	open woods	high
<i>Astragalus umbraticus</i>	woodland milk vetch	TS	woods	medium
<i>Bensoniella oregona</i>	Bensoniella	BS	wet meadows	low
<i>Carex barbarae</i>	Santa Barbara sedge	TS	meadows	high
<i>Cimicifuga elata</i>	tall bugbane	BS	woods, thickets	low
<i>Cypripedium fasciculatum</i>	clustered lady's slipper	BS SM 1,2	woods	low
<i>Cypripedium montanum</i>	mountain lady's slipper	TS, SM 1,2	woods	low
<i>Dichelostemma ida-maia</i>	firecracker flower	TS	woods, meadows	high
<i>Eschscholzia caespitosa</i>	gold poppy	AS	fields, brushy slopes	low
<i>Festuca elmeri</i>	Elmer's fescue	TS	dry wooded slopes	low
<i>Horkelia congesta</i> ssp. <i>congesta</i>	dense flowered horkelia	BS	meadows, open woods	medium
<i>Lewisia cotedon</i> var. <i>howellii</i>	imperial lewisia	TS	outcrops	low
<i>Lupinus sulphureus</i> var. <i>kincaidii</i> (<i>L. oregonus</i> var. <i>kincaidii</i>)	Kincaid's lupine	BS, SLT, FPT	woods, meadows	low
<i>Mimulus kelloggii</i>	Kellogg's monkeyflower	TS	open slopes	low
<i>Montia howellia</i>	Howell's montia	BS	outcrops	medium
<i>Pellaea andromedaefolia</i>	coffee fern	AS	outcrops	medium
<i>Perideridia erythorhiza</i>	false caraway	BS	woods, meadows	high
<i>Perideridia howellii</i>	Howell's false caraway	TS	woods	high
<i>Phacelia verna</i>	spring phacelia	TS	outcrops	high
<i>Plagiobothrys hirtus</i>	rough popcorn flower	FPE, SLE	wet meadows	low
<i>Polystichum californicum</i>	California shield fern	AS	outcrops	low
<i>Romanzoffia thompsonii</i>	Thompson's mistmaiden	BS	wet outcrops	low
<i>Sidalcea cusickii</i>	Cusick's sidalcea	TS	wet meadows, ditches	high
<i>Sisyrinchium hitchcockii</i>	Hitchcock's blue-eyed grass	BS	valley grasslands, oak savannahs	high
<i>Verbena hasta</i>	blue verbena	TS	moist banks	medium
<i>Funaria mulenbergia</i>	Mulenberg's cord moss	AS	exposed soil	low
<i>Hypogymnia oceanica</i>	lichen	AS, SM 1,3	bark, wood conifers	low
<i>Hypogymnia duplicata</i>	lichen	TS, SM 1,2,3	bark, wood conifers	low
<i>Lobaria linita</i>	lichen	AS, SM 1,2,3	trees, shrubs, mossy rocks	low
<i>Nephroma occulium</i>	lichen	AS, SM 1,3	bark of conifers	low
<i>Racomitrium pacificum</i>	moss	AS	seasonally wet, outcrops	low

*AS=assessrment species, BS=bureau sensitive, TS=tracking species, FPE=federal proposed endangered, FPT= federal proposed threatened, SLE=state listed endangered, SLT=state listed threatened, SM=Survey and Manage

Table 3-12

Areas of Possible Special Status Plant Habitat

Identified by Forest Operations Inventory and Aerial Photograph Interpretation. Bold type common to both methods of analysis.

Sections identified by Forest Operations Inventory

T22S-07W-14	3.85	Acres
T23S-06W-29	9.98	Acres
T23S-07W-35	17.2	Acres
T24S-07W-23	2.22	Acres

Sections Identified by Aerial Photograph

T22S-07W-09	T23S-06W-07	T24S-06W-05	T24S-07W-11
T22S-07W-11	T23S-06W-31	T24S-06W-09	T24S-07W-15
T22S-07W-15	T23S-06W-33	T24S-06W-17	T24S-07W-23
T22S-07W-23	T23S-07W-03	T24S-06W-19	T24S-07W-25
T22S-07W-27	T23S-07W-13	T24S-06W-29	T24S-07W-27
T22S-07W-35	T23S-07W-23	T24S-06W-31	
	T23S-07W-25	T24S-07W-01	
	T23S-07W-31	T24S-07W-03	
	T23S-07W-35	T24S-07W-05	
		T24S-07W-09	

Survey and Manage Species Known to occur in Elkton-Umpqua and/or adjacent Watersheds

Table 3-13

Species

Habit

Survey Strategy *

<i>Aleuria rhenana</i>	fungus	PB
<i>Cantharellus cibarius</i>	fungus	3,4
<i>Cantharellus tubiformis</i>	fungus	3,4
<i>Cantharellus subalbidus</i>	fungus	3,4
<i>Clavariadelphus truncatus</i>	fungus	3,4
<i>Gomphus floccosus</i>	fungus	3
<i>Gyromitra infula</i>	fungus	3,4
<i>Gyromitra escuelensis</i>	fungus	3,4
<i>Helvella compressa</i>	fungus	1,3
<i>Hydnum repandum</i>	fungus	3
<i>Hydnum umbilicatum</i>	fungus	3
<i>Hypomyces luteovirens</i>	fungus	3
<i>Sparasis crispa</i>	fungus	3
<i>Otidea onotica</i>	fungus	PB
<i>Otidea leporina</i>	fungus	PB
<i>Phaeocollybia californica</i>	fungus	1,3
<i>Phaeocollybia spadicea</i>	fungus	3
<i>Phaeocollybia attenuata</i>	fungus	3
<i>Phaeocollybia olivacea</i>	fungus	3
<i>Pholgoitis helvelloides</i>	fungus	3,4
<i>Plectania melastoma</i>	fungus	3
<i>Sarcodon fuscoindicum</i>	fungus	3
<i>Sarcosphaera exima</i>	fungus	3
<i>Lobaria oregana</i>	lichen	4
<i>Lobaria pulmonaria</i>	lichen	4
<i>Nephroma bellum</i>	lichen	4
<i>Nephroma parile</i>	lichen	4
<i>Nephroma laevigatum</i>	lichen	4
<i>Pseudocyphallaria crocata</i>	lichen	4
<i>Pseudocyphallaria anthraxis</i>	lichen	4
<i>Pseudocyphallaria anomala</i>	lichen	4
<i>Sticta fuliginosa</i>	lichen	4
<i>Usnea longissima</i>	lichen	4
<i>Antetrichia californica</i>	moss	4
<i>Buxbaumia viridis</i>	moss	PB

*PB= protection buffer, 1=manage known sites, 2=survey prior to activities and manage sites, 3=conduct extensive surveys and manage sites, 4=conduct general regional surveys (Roseburg District ROD)

Table 3-14

Suspected or Known Weed Sites

Species name Relative Abundance	Common name	ODA	Rank	Status
<i>Senecio jacobaea</i>	tansy ragwort	B, T	K	widespread
<i>Ulex europaeus</i> *	Gorse	B, T	S	adjacent watersheds
<i>Carthamus lanatus</i>	woolly distaff thistle	A, T	K	adjacent watersheds
<i>Chondrilla juncea</i>	rush skeleton weed	B, T	S	adjacent watersheds
<i>Lythrum salicaria</i> *	purple loosestrife	B	S	adjacent watersheds
<i>Centaurea diffusa</i> *	diffuse knapweed	B	S	adjacent watersheds
<i>Centaurea solstitialis</i> *	yellow star thistle	B, T	S	adjacent watersheds
<i>Cirsium arvense</i> *	canada thistle	B	K	widespread
<i>Cirsium vulgare</i> *	bull thistle	B	K	widespread
<i>Hypericum perforatum</i> *	St. John's wort	B	K	present
<i>Cystisus scoparius</i> *	scotch broom	B	K	widespread

A - species populations not yet found in Oregon or are very restricted

B - species that are known to occur throughout the state or in large regions of the state

T - Target list; priority for control

* biological controls have been approved

Table 3-15

Existing Weed Populations

Identified by personal observation and aerial photography.

24-6-19.3 road	upper portions of Yellow Creek subwatershed (LSR)
24-6-29.0 road	
24-7-25.0 road	last 1/2-3/4 of mile of road
22-7-20.0 road	dirt spur leading to Bell Mt. timber sale unit
23S-07W-13	along the 23-7-12.0 rd and large patches in east half
23S-07W-25	along the 23-7-33.1rd and northeast 1/4
23S-07W-35	large patches

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WILDLIFE HABITAT AND SPECIES

A. Introduction

The Northwest Forest Plan (NFP) currently provides an adequate strategy for conservation and viability for species that are dependent on LSH but are not on the list of species in Table C-3 of the ROD. The success of this conservation strategy is dependent on the integrity and composition of the reserve system, the riparian reserves, the LSR and connectivity sections and other reserves designated for special status species and natural areas. Current habitat conditions in the reserve system and its functionality are described later in this section. This analysis, together with the aquatic section analysis provides a body of information on which to base decisions concerning adjustments of the riparian reserve boundaries. Although many sensitive species listed as threatened or endangered occur in this WAU (Table 4-1), it is not the role of this document to further analyze the impacts of the forest plan on them. Instead it seeks only to describe special land use designations where they are included for specific protection of these animals and to explain the functions of these areas.

B. Key Questions

1. What species of concern currently utilize this WAU?
2. What is the area of functioning interior habitats and their interconnectiveness (as related to Late-Successional Reserves)?
3. What is the area of functioning habitat on a snag and coarse woody debris (CWD) basis? [A sub-section of this topic includes an issue related to aquatic habitat and fish: What is the area of functioning riparian habitat on a snag and CWD basis? This topic is further discussed in that section.]

C. Special Status Species

The species of concern that currently are known to utilize Elkton-Umpqua WAU are shown in Table 4-1 (page 4-??).

1. Critical Habitats

In addition to the species there are designated critical habitats for the northern spotted owl (Fed. Reg. 1992) and the marbled murrelet (Fed. Reg. 1996) within the WAU. Designated critical habitats for both species only encumber federal lands. Approximately 25,494 acres have been designated as critical habitat for the northern spotted owl (Figure 4-1), 17,097 acres are within LSR and the remainder is in Matrix.

Fifteen thousand, five hundred and thirty (15,530) acres have been designated as marbled murrelet critical habitat (Figure 4-2), all of it in LSR. Critical habitat was designated by quarter-section and section units, within each lot only those lands containing the following primary constituent elements are technically considered to be critical habitat:

- 1) individual trees with potential nesting platforms and
- 2) forested areas within 0.8 km (0.5 mi) of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height. (Fed. Reg. 1996).

2. Other Habitat Management Plans

There are, approximately, 1820 acres designated for bald eagle habitat management, within the WAU, under the Umpqua River Corridor Habitat Management Plan (USDI 1985). The goal of this plan was to "...protect, improve, and perpetuate the integrity of...nesting territories." This HMP encompasses most federal land along the mainstem Umpqua, from the town of Elkton to the confluence of the North and South Umpqua Rivers (Figure 4-3).

3. Northern Spotted Owls

There are 29 known spotted owl sites (26, at least partly, on federal lands) within the Elkton-Umpqua WAU. these include a total of 49 individual core areas. This WAU is contained within the Tyee Demography Study Area and has been monitored intensively since 1990, individual sites may have been followed since 1985, or before. Thirty-one (31) core areas occur within LSRs 1 or 2. There are 6, additional, residual habitat areas that protect 7 core areas.

There are 15,136 acres of suitable spotted owl habitat on federal lands within the watershed (51 percent). Seventy-seven (77) percent of the habitat is contained within LSRs 1 and 2. Nine thousand, seven hundred and forty-five

(9,745) acres of suitable spotted owl habitat are contained within designated critical habitat for the northern spotted owl. Since 1960, 43 percent of the federal lands within the WAU (12,854 acres) have been lost or degraded, mostly to harvest.

There are 19,683 acres of suitable spotted owl dispersal habitat (forestland greater than 11 inches in diameter with a canopy cover greater than 40 percent) on federal land, within the Elkton-Umpqua WAU [for analysis forested stands greater than 30 year of age are considered to dispersal habitat]. Seventy-three (73) percent of the dispersal habitat is located in LSRs.

4. Marbled Murrelets

There is one occupied marbled murrelet site in this WAU. Twenty-seven (27) sites have been surveyed in this area. Forty-two (42) percent of this watershed (26 percent of the available marbled murrelet habitat) occurs within 35 miles of the coast, the remainder occurs within 50 miles. Within the Elkton-Umpqua watershed there are 14,705 acres of federal forest that is classified as suitable marbled murrelet habitat, 76 percent of this habitat is protected in LSR, 43 percent is contained within designated critical habitat. Like the spotted owl, 43 percent of the suitable habitat on federal lands within the WAU (12,854 acres) have been lost or degraded, since 1960.

5. Bald Eagle

There are four bald eagle nest sites located within the Elkton-Umpqua WAU, three are located entirely on federal lands. These sites have been monitored for, at least, the past 10 years by researchers from Oregon State University. All sites on federal lands are protected by the Umpqua River Corridor HMP and the NFP.

6. Red Tree Vole

There are 19,683 acres (66 percent of federal land) of suitable red tree vole habitat, conifer stands of 10+ inches in diameter, with a canopy closure greater than 60 percent, on federal lands within the watershed [for analysis forested stands greater than 30 years of age are considered to be suitable habitat]. 14,368 acres (73 percent) are contained within LSRs.

D. Area of Functioning Interior Habitats

The analyses for this key question and question 3 were completed using data compiled from the satellite imagery as explained under the previous **Vegetation** section. The same limitations that applied under the vegetation section also apply to this data. (See pages 3-1 and 3-2 under the **Vegetation** section for a discussion of the strengths and weaknesses of the data.) The 11 vegetative classes used for analysis are:

- Water
- Urban_ag
- Non-forest vegetation (inc. recent clearcuts)
- Barren
- Sapling (dia < 10" and can. clos. < 50%)
- Pole (dia < 10" and can. clos. > 50%)
- Sm saw (dia > 10" and < 20")
- Lg saw (dia > 20" and < 30")
- Old growth (dia > 30")
- Urban
- No Data

Analysis of forested habitat require further lumping of data into 3 seral stages:

- Early (0-30 years of age; includes non-forest vegetation, sapling, pole)
- Mid (30-80 years of age; includes sm saw)
- Late (80+ years of age; includes lg saw and old growth)

Since this information was collected in 1992 at least 3 timber sales have been implemented, or will be implemented, that are not reflected in these numbers. They are the Upper Renhaven, Diamondback, and Four Gates timber sales. Bell Mountain is currently in the planning stages.

1. Late Seral Habitat

There are more than 23,000 acres of late-successional habitat within the Elkton-Umpqua watershed analysis unit, 13,441 acres on federal land and 9,783 acres on private. Almost 9900 acres (73 percent of federal late seral habitat) are protected in LSRs (47 percent) (Table 2-1). Since approximately 1962, 17,908 acres of the watershed has been harvested (43.6 percent of the late seral habitat available in 1962); 3,346 acres have been harvested in LSRs (25 percent of the late seral habitat available in 1962).

2. Interior Habitat

Late seral forests are important to many species because of the variety of micro-climates and special habitats that exists in that forest type. Micro-climates are affected by many environmental variables -- wind speed, relative humidity, temperature, light penetration, to name a few. Research has shown that micro-climate variability is a factor of forest edge type and distance from that edge. In this analysis an "edge effect" of 600 feet was modeled for high contract edges and 150 feet for low contract edges. High contract edges were modeled as those between late seral forests and early seral or non-forested types. Low contract edges were modeled as those between late seral forests and mid seral forests or hardwood types. Ideally a circle would have to be at least 26 acres in size before it would support "interior late seral" habitat, with a high contrast edge. Estimates of interior late seral is not available at this time because of modeling problems.

Table 4-2

Late successional patch characteristics within the Elkton-Umpqua WAU				
	Late Successional Habitat		Late Successional Habitat in LSR (Cat. 1 & 2)	
	All patches	Patches > 26 acres	All patches	Patches > 26 acres
Number	892	109	340	63
Area (acres)	23226	20088	9885	8824
Minimum size (acres)*	0	26	0	27
Maximum size (acres)	2084	2084	917	917
Average size (acres)	26	184	29	140
* size = 0 is less than 0.01 acres in size.				

There are 109 patches of late seral habitat that are greater than or equal to 26 acres in size (12.3 percent of all late seral patches), 63 are within LSRs (18.6 percent of LSR patches). These numbers are not good indicators of true interior habitats because most of the stands are linear, and thus would not contain comparable amounts of interior habitat as those that are more circular.

3. Connectivity

Without a sophisticated modeling algorithm connectivity is a hard measure to get at. I have analyzed the watershed based upon 1000 meter pixels. Based upon visual estimation of the content of each pixel it may have been labeled as a dispersal block. Dispersal blocks contained more than 30 percent late seral habitat.

Of the 438 pixels that cover the Elkton-Umpqua WAU, 102 are estimated to contain 30 percent, or more, of late seral habitat. There are no direction connections of adjacent dispersal blocks either in a north-south or east-west direction that spans the watershed. The first north-south connection occurs if you allow a 2 km gap between blocks. The first east-west connection does not occur until a 3 km gap is allowed. Twenty-two (22) of the connectivity blocks occur west of the river. Movement north-south, on the west side of the river, does not occur until a 4 km gap between blocks is allowed. This analysis may work for estimating effects on the dispersal ability of avian and large mammal species but it probably does not work for smaller mammals and other, small terrestrial species.

Late seral habitat exists outside of these connectivity blocks and may strengthen the dispersal ability of late seral species across the landscape, however there is no contiguous path of late seral habitat across the watershed in any directions. Two major obstacles to the abilities of small mammals and other small terrestrial species to disperse across the watershed are the Umpqua River and the large amount of agricultural/pasture land that occurs in the valley bottoms. These obstacles essentially limit all east-west movement across the watershed for all but the largest mammal species and birds.

Dispersal between LSRs follows the same limitations as discussed above.

E. Functioning Habitat for Snag and Coarse Woody Debris

Analysis for this key question also utilizes the WODIP data. For discussion of this key question the following assumption is made (although a number of stands harvested in the past, prior to the recent era of clearcut regeneration, contained a wealth of snags, CWD and cull trees):

Forests that have not been subject to regeneration harvests are currently functioning at satisfactory levels in regards to CWD and snag levels and recruitment.

For discussion purposes, only late seral forests are believed to meet this requirement. [The data for this assumption in late seral forests is probably skewed since it is unknown where mortality salvage and partial cutting took place.] This analysis is a starting point, a process to identify potential problem areas. Prior to implementing solutions more in-depth field surveys would be needed.

The draft LSR management assessment for the Southern Coast Range/Northern Klamath LSRs (which includes LSRs OR-263 and OR-264 of which portions are within Elkton-Umpqua WAU) identifies average values for snags and CWD abundance in naturally regenerated stands (pages 28-31 of LSRA, Tables 8, 9, 10, and 11). Table 4-3 below summarizes that information.

Table 4-3

Structural components of naturally regenerated Douglas-fir forests.				
		Young (40-80 yrs)	Mature (80-195 yrs)	Old Growth (195+ yrs)
Downed Wood (> 4" dia. at the large end; all decay classes)		1,102 cu. ft./ac. (525-1,979)	1,731 cu. ft./ac. (300-3,162)	3,262 cu. ft./ac. (1,382-5,141)
Snags (> 4 in. diameter and > 4 ft. tall)	20+ in. diameter	7 per ac. (3-31)	7 per ac. (0-14)	7 per ac. (4-10)
	20+ in. dia. and 16+ ft. tall	2 per ac. (0-4)	3 per ac. (0-7)	4 per ac. (2-6)
	< 20 in. dia.	48 per ac. (26-70)	53 per ac. (1-105)	17 per ac. (14-20)

Based upon the assumption stated above, 72% of the forested habitat in the WAU is currently not functioning for CWD and snags (Table 3-4). Based on that vegetation data approximately 23% (20,433 acres) of the forested lands in this WAU has been harvested since 1962 resulting in impaired CWD and snag systems. ~~Commercial regeneration harvests and subsequent, intensive timber management does not allow/maintain CWD/snags of suitable size, nor do they provide for the continued recruitment of CWD/snags necessary to provide for and/or recover those terrestrial, plant and animal species that require snags and CWD (I THOUGHT THE RMP TOOK CARE OF THIS ON THE BROAD LANDSCAPE, NEEDS CLARIFICATION)~~ The loss of organic material can result in a loss of soil structure, soil nutrients, moisture holding capacity, energy dissipators (overland waterflow), microsites for plant establishment, and food source of vertebrate and invertebrate animal life.

Approximately 25,063 acres of federal ownership are classified as some type of reserve. Approximately 55% (13,666 acres) of these reserves is currently in a functioning condition in regards to CWD and snags (Table 1-3).

Approximately 31% (7,759 acres) of these reserves have been harvested since approximately 1962 and are in the process of growing toward late seral conditions. Past intensive forest management practices on federal lands did several things to the snag/CWD system:

- 1) At the time of harvest it tended to eliminate defective trees and snags, thus eliminating the source of CWD
- 2) Harvesting tended to breakup or remove existing CWD
- 3) Without the residual large diameter trees that tend to be left as a result of some disturbance (fire/wind/pathogen) there is a lag of 150+ years before large diameter trees can grow and die in regenerating stands
- 4) Pre-commercial and commercial thinnings are designed to capture the mortality that creates snags and CWD
- 5) Intensive silviculture does not promote a diversity of stem structure and growth rates resulting in lower rates of stem decay than in natural stands
- 6) Multiple rotations of intensive forestry would essentially eliminate the roles that snags and CWD play in a fully functioning forest ecosystem.

Guidelines that exist on federal lands strive to maintain/create some of the functions that have been lost through past regeneration harvest but the large diameter, standing snags; large diameter, residual trees; and genetic diversity that might have allowed a stand to differentiate and begin suppression mortality sooner have been lost in previously harvested stands. Currently trees that are left in harvest units will take several rotations before they die and provide the large diameter snags and subsequent CWD necessary. This is true equally for the upland and the riparian ecosystems. See the Aquatic Habitat and Fish section for further discussions.

Special Status Species¹ Possibly Occurring in Elkton-Umpqua WAU

Table 4-1

Species	Historic Distribution	Current Distribution	Habitat Requirements	Special Status
Southern torrent salamander <i>Rhyacotriton variegatus</i>	YES	YES	Springs and streams	riparian/wetland, coarse woody debris (CWD)
Clouded salamander <i>Aneides ferreus</i>	YES	YES	Forested habitats	CWD/talus
Tailed frog <i>Ascaphus truei</i>	YES	YES	High gradient, perennial streams	Cobbles/boulders, riparian
Northern red-legged frog <i>Rana aurora aurora</i>	YES	YES	Low gradient streams/ponds	Aquatic vegetation
Foothill yellow-legged frog <i>R. boylei</i>	YES	YES	Low gradient streams/ponds	Gravel/cobbles, riparian
Northwestern pond turtle <i>Clemmys marmorata marmorata</i>	YES	YES	Ponds, low gradient rivers	CWD, rocks, riparian (basking sites)
Sharptailed snake <i>Contia tenuis</i>	YES	YES	Forested habitats	CWD, talus, riparian
Common kingsnake <i>Lampropeltis getulus</i>	YES	YES	Grassland, mixed oak woodlands	riparian
Bald eagle <i>Haliaeetus leucocephalus</i>	YES	YES	Late-successional conifer forests	Lg. diameter trees/snags
Northern goshawk <i>Accipiter gentilis</i>	UNKNOWN PROBABLE	UNKNOWN PROBABLE	Mature and older conifer forests	
American peregrine falcon <i>Falco peregrinus anatum</i>	UNKNOWN	UNKNOWN	Cliffs	
Mountain quail <i>Oreotyx pictus</i>	YES	YES	Forested habitat	Shrub component
Marbled murrelet <i>Brachyramphus marmoratus</i>	YES	UNKNOWN	Late-successional conifer forests	Lg. diameter trees/limbs, platforms
Northern pygmy owl <i>Glaucidium gnoma</i>	YES	YES	Mature and older conifer forests	Snags, cavities, edge habitat
Northern spotted owl <i>Strix occidentalis caurina</i>	YES	YES	Late-successional conifer forests	Lg. diameter trees, snags, cavities
Northern saw-whet owl <i>Aegolius acadicus</i>	YES	YES	Mature and older woodlands	Cavities, snags
Pileated woodpecker <i>Dryocopus pileatus</i>	YES	YES	Forests 40 years and older	Snags

Purple martin <i>Progne subis</i>	YES	UNKNOWN PROBABLE	Grasslands, brushlands, open woodlands	Cavities
Hoary bat <i>Lasiurus cinereus</i>	YES	YES	Late-successional conifer forests, associated with water	Caves and mines, snags
Yuma myotis <i>Myotis yumenensis</i>	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, buildings, snags
Long-eared myotis <i>M. evotis</i>	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, snags
Fringed Myotis <i>M. thysanodes</i>	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, rock crevices
Long-legged myotis <i>M. volans</i>	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, loose bark, rock crevices
Silver haired bat <i>Lasionycteris noctivagans</i>	YES	YES	Late-successional conifer forests, associated with water	Caves/mines, bridges, loose bark, rock crevices, snags
Pacific Townsend's big-eared bat <i>Corynorhinus townsendii townsendii</i>	YES	YES	Late-successional conifer forests	Caves/mines, buildings, bridges
Pacific pallid bat <i>Antrozous pallidus pacificus</i>	YES	UNKNOWN PROBABLE	Ponderosa pine, oak woodlands	Buildings, bridges, snags
Columbian white-tailed deer <i>Odocoileus virginianus leucurus</i>	YES	NO	Bottomlands, oak/hardwood forests	
White-footed vole <i>Phenacomys (=Arborimus) albipes</i>	YES	UNKNOWN PROBABLE	Riparian alder/hardwood forests	
Red tree vole <i>P. longicaudus</i>	YES	YES	Douglas-fir forests	Platforms, large dia. limbs, cavities, high canopy closure
Oregon shoulderband <i>Helminthoglypta hertleini</i>	UNKNOWN	UNKNOWN	Forest and Talus	Talus/rocks
Oregon megomphix <i>Megomphix hemphilli</i>	YES	UNKNOWN PROBABLE	Conifer	Big leaf maples
Blue-gray tail-dropper <i>Prophysaon coeruleum</i>	YES	UNKNOWN PROBABLE	Conifer	Hardwoods
Papilose tail-dropper <i>P. dubium</i>	YES	UNKNOWN PROBABLE	Conifer	Hardwoods

¹ This table contains a list of species that meet the Special Status Species definition in the BLM's 6830 manual, and those species of concern identified in the NFP as Survey and Manage and Protection Buffer, and Species identified in Appendix J2 of the NFP.

Figure 4-1

1S

2S

1S

1S

MEHL
CREEK

ELKTON

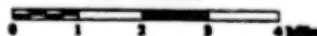
YELLOW
CREEK

MCGEE
CREEK

LOST
CANYON

**Designated Critical Habitat
for the Northern Spotted Owl
in the Elkton-Umpqua WAU.**

Scale 1:100000



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was collected from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

Spotted Owl Critical Habitat



Figure 4-2

**Designated Critical Habitat
for the Marbled Murrelet
in the Elkton-Umpqua WAU.**

1S

2S

MEHL
CREEK

ELKTON

YELLOW
CREEK

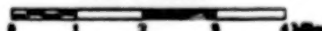
MCGEE
CREEK

1S

LOST
CANYON

1S

Scale 1:100000



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.



Figure 4-3

1S

**Federal lands included in the
Umpqua River Corridor HMP.**

2S

MEHL
CREEK

ELKTON

YELLOW
CREEK

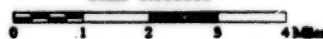
MC GEE
CREEK

1S

LOST
CANYON

1S

Scale 1:100000



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

HYDROLOGY

A. Introduction

The Elkton-Umpqua WAU is part of two fifth-field watersheds and consists of five sixth-field subwatersheds (Figure 1-4). The Elkton subwatershed is one of 11 subwatersheds in the Elk Creek fifth-field watershed. Lost Canyon, Mehl Creek, McGee Creek, and Yellow Creek subwatersheds are four of nine subwatersheds in the Upper Umpqua fifth-field watershed. The WAU is composed of 25 seventh-field drainages and are represented by Figure 1-4. The Yellow creek subwatershed is the only discrete watershed, and by definition, contains streams that only drain Yellow creek. All other subwatersheds (sixth-field) are frontal to the Umpqua River or Elk Creek which drain a much larger area than the delineated size of the drainage.

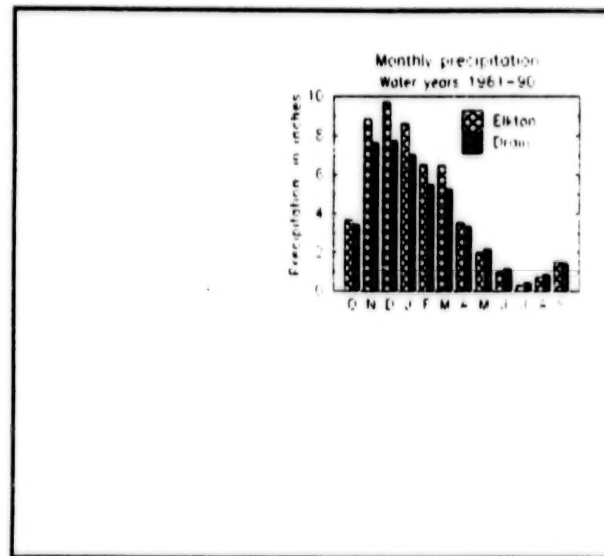
A combination of land uses (grazing, agriculture stock watering, timber harvest and roads) along the Umpqua River and the lower reaches of frontal tributaries to the Umpqua have probably decreased summer low-flows, altered the timing and magnitude of peak flows, and altered water quality. Increased peak flows can result in changes to the dimension, pattern, and profile of streams, increased flooding downstream, and ultimately degradation of fish habitat. Loss of vegetative cover, compaction of soils due to roads and skid trails, the conversion of sub-surface flow to the surface flow by road cut-banks, and the extension of the stream network by road ditch lines and culverts, have been shown to increase peak flows (Coffin and Harr 1992, Jones and Grant 1996, King and Tennyson 1984), Megahan 1971, Wemple, et al. 1996).

Geology shapes the drainage patterns, determines the type of sediment available to the streams, and influences water chemistry. The Tyee Formation is the predominant geologic strata within this WAU, and is greatly affected by the orientation with or against the dip (see Soils Report). Twenty five percent is in the Elkton Formation, and is primarily located west of the Umpqua River. Soils are a product of weathered bedrock. Water infiltration rates, erosion potential, and vegetation differ among soil types and topography. Vegetative cover (or lack of cover) along streams affects channel stability, stream morphology, stream temperature, and coarse woody debris. Trees and shrubs along streams provide root strength to stabilize stream banks, shade, organic debris, and coarse woody debris to streams. Organic debris includes leaf litter, which is an important component of the food chain, and LWD, which form pools and capture spawning gravels. Soil compaction from roads, livestock grazing, and intense fires have also reduced soil infiltration along streams in the WAU.

B. Climate

The Elkton-Umpqua WAU has a Mediterranean type of climate, characterized by cool, wet winters and hot, dry summers. The closest NOAA weather station to the study area is in Elkton, OR at an elevation of 120 feet. The highest elevation is 2600 feet near Tyee Mountain, which receives more precipitation than the weather station due to orographic effects. Differences in temperatures and precipitation will vary throughout the watershed depending on topographic position and slope aspect. The upper elevations of the WAU could receive as much as 60 inches of precipitation. The climate data presented below are 1961-1990 mean data from Owenby and Ezell, 1992. Average annual precipitation at Elkton is 53 inches, with approximately 85% of the precipitation occurring from October to April and average summer precipitation is 6 inches (Chart 5-1 and Table 5-1). Since most of the study area is below 2000 feet elevation, streamflow is driven mostly by precipitation.

Chart 5-1.
Comparison of Average Monthly Precipitation
at Drain and Elkton, Oregon for water years 1961 to 1990.



Comparison of annual precipitation and temperature data for stations near the WAU.

Table 5-1

Station	Precipitation, inches	Temperature, in °F		
		Mean	Maximum	Minimum
Elkton 3 SW	52.9	55	66	43
Cottage Grove 1 S	45.6	52	64	40
Cottage Grove Dam	48.1	51	62	41

Chart 5-2 shows the deviation from the mean of water year precipitation and temperature from 1904 to 1997 at Drain, Oregon. Large deviations in precipitation in 1956, 1974, and 1996 correspond with flooding in the WAU. Conversely, the dry 1994 water year is reflected in the large deviation in the negative direction.

C. Water Quality

How have previous land management activities affected water quality?

A combination factors have worsened water quality over time along the Umpqua River, Elk creek, Little Tom Folly, and the numerous frontal drainages. Along larger streams, such as the Umpqua River and Elk creek; agriculture, water withdrawals, roads, grazing, developments, and point sources of pollution have degraded water quality. The loss of riparian vegetation and shade along these streams has led to increased stream temperatures and subsequent listing by DEQ as being water quality limited.

Natural and anthropogenic caused erosional processes have contributed sediment to streams and probably impacted aquatic habitat to some degree. Landslides naturally transport sediment and wood to lower order downstream reaches, and can scour higher gradient headwater streams to bedrock. Landslides not related to management activities can identify inherently unstable areas across the landscape. A detailed landslide inventory and an assessment can be found in the

GEOLOGY, SOILS and STREAM CHANNELS section.

Table 5-2 displays the road densities, drainage characteristics, and stream crossings for the WAU. There are 586 miles of road identified by GIS in the WAU, with 160 miles administered by the BLM. Stream crossings can fail during moderate flow events causing road wash-outs and hillslope erosion resulting from the stream being diverted out of its channel. Information gathered at stream crossings could be used to determine: 1) the potential for culverts to plug, 2) culvert flow capacities compared to predicted stream peak flows, and 3) the potential for streams to be diverted out of their channels as a result of stream crossing failures. GIS identified approximately 1000 stream crossings in the WAU, with 195 located on BLM administered lands **Table 5-2**.

High flows can cause culverts to plug and streams diverted out of their channels from stream crossing failures. Streams construct and maintain their channels, and are sensitive to changes in discharge and sediment loads. Streams route the most sediment over time during flows at or near bankfull. Increased sediment loads from upstream sources may cause bank erosion and streams to widen to carry the additional sediment. Dose and Roper concluded in the upper South Umpqua basin that land management activities, including road building, can have a profound effect on low-flow wetted channel widths, and cause subsequent effects to summer stream temperatures. The presence of large woody debris within the active channel can have a mitigating affect on increases in channel width.

An assessment of water quality encompasses several elements important to beneficial uses including temperature, microbiology, chemistry, and clarity. Water temperature and riparian interrelationships are discussed later in the document. Water clarity is a good visual indicator of the presence of suspended sediments or excessive nutrient loading. Turbidity is a term that refers to the optical property of a fluid, or relative cloudiness of the water (Hach 1972). Suspended fine sediments increase turbidity, thus reducing water clarity. Excessive nutrient loading and/or high stream temperatures promote the growth of algae, which reduces water clarity. Increases in turbidity and suspended sediments, may detrimentally affect fish and other aquatic life, especially if high levels occur over long periods of time.

Water clarity is generally high for most of the frontal compartment drainages in the WAU. Streamflow is generally clear most of the year, except during winter storms which tend to flush accumulated channel debris and sediment. High intensity winter storms producing bankfull or greater streamflow may cause bank erosion, culvert failures, and slides that contribute sediment to streams. The Umpqua River is likely to remain turbid for several days following a winter storm because of the large watershed area draining the WAU. The high stream gradients and water velocities of the frontal drainages in the WAU tend to transport fine sediments rapidly into the Umpqua, allowing rapid water clarity recovery following a period of little or no precipitation.

Elk creek and Umpqua River have been identified as water quality limited for several parameters, such as temperature, dissolved oxygen, flow modification, and fecal coliform. The beneficial uses affected by these water quality conditions are water contact recreation, resident fish and aquatic life, salmonid spawning and rearing, and aesthetics.

The information available on water chemistry comes from project specific monitoring of aerial fertilization activities during the fall 1997. Monitoring protocol involved monitoring prior to, and after aerial applications were conducted to determine impacts to water quality. Nitrate-nitrite nitrogen, ammonium nitrate, total Kjeldahl nitrogen, pH, and conductivity were analyzed by a local laboratory. One site was located within the WAU, while four others were located outside the WAU, and drain into Elk creek. The results indicate that nitrates, ammonium nitrate, and total Kjeldahl nitrogen are present in relatively low quantities before and after aerial fertilization. Measurements of pH ranged from 7.09 to 7.87 and conductivity ranged from 45 to 894 micro Siemens/cm at 25° Celsius. All measured parameters are well within limits established set by the EPA (EPA 1986) and State water quality standards. Water quality data collected in Bear and Yellow creeks are displayed in **Table 5-3**. The data indicates the water quality parameters are within the standards set forth by Oregon DEQ; however, pH during the summer 1996 is near the upper range (8.5).

Spring 1996

Table 5-3

Creek	Time	Q _a	EC uS/cm	pH	Alk. mg/l	Temp °C	Barometric Pressure	DO _{mg/l}
Bear	1500	7.0	55	7.5	----	9.0	774	10.8

Summer 1996

Creek	Time	Q _a	EC uS/cm	pH	Alk. mg/l	Temp °C	Barometric Pressure	DO _{mg/l}
Bear	1200	0.4	78	7.9	34	15.5	748	9.4
Yellow	1330	1.01	109	8.1	43	17	753	9.7

D. Stream Temperature

What are current stream temperatures?

Stream temperature is influenced by several factors including stream morphology, solar radiation intensity, vegetative cover, air temperature, steepness of streambanks, streamflow, and direction of flow (orientation to the sun). Stream temperatures were monitored at three sites during the summers of 1996 and 1997 (Chart 5-3, 5-4), and all three sites are located within the Yellow Creek subwatershed. Stream temperature is a major factor influencing the composition and productivity of the aquatic environment. Fish, aquatic organisms, and benthic macroinvertebrates are directly and indirectly affected by changes in water temperature. This is especially significant in areas devoid of riparian shade, where increases in diurnal water temperature fluctuation can stress aquatic organisms. This appears especially true for Yellow creek at the mouth, where temperatures exceed the Umpqua basin temperature standard of 64 degrees fahrenheit during the 1996 and 1997 summer months. The stream has a high width/depth ratio, low gradient, shallow flow, and the existing riparian vegetation does not provide effective shading to the stream. Bear creek at the mouth and Yellow creek above Bear sites are significantly cooler throughout the summer, and exhibit less diurnal fluctuation than Yellow creek at the mouth. At these sites, the riparian vegetation is denser, width/depth ratio is less, and less solar radiation may be reaching the stream.

E. Hydrologic Flows

What are the hydrologic processes in the WAU?

1. Characterization

The amount, intensity, duration, and distribution of precipitation, vegetative cover, ground compaction caused by tractor harvest and road construction, interception of ground water at road cut-slopes, extension of channel network as result of road ditch-lines, geology, and geomorphology affect all aspects of high, annual and low flows in the WAU. The magnitude, duration, and frequency of peakflows affect channel morphology, fish habitat, spawning access, and fish survival. Low flows influence fish migration, availability of habitat to aquatic species, affects of water temperature on fish survival and growth, and the health and diversity of aquatic macroinvertebrates. The quantity of streamflow affects aquatic habitat and other beneficial uses.

The bankfull stage is the stage of incipient overflow and corresponds to the discharge at which channel maintenance is most effective in routing sediment, forming or removing bars, and forming or changing the meanders of streams. A plot of the annual flood series for the Umpqua @ Elkton, Oregon gauging station, the recurrence interval for bankfull discharge is approximately 1.5 years. A discharge equal to or greater than bankfull has occurred two out of three years. Flows of this magnitude are not likely to damage structures. Flood stage at this gauge is 33 feet and peak flows exceeding this elevation are likely to overflow the low terrace and may cause substantial damage. The discharge at this gauge height is 126,500 cubic feet per second (cfs) and was exceeded several times during the period of record (Chart 5-5).

The movement of water through a watershed is influenced by the vegetation cover. Young stands of timber are subject to earlier, faster runoff as precipitation occurs and evapotranspiration is reduced resulting in direct surface runoff. Older stands are less likely to have overland flow because of higher water storage capacities. Much of the valley adjacent to the Umpqua River and lower Elk creek is utilized for agriculture. The Elkton, Mehl, and Mcgee Creek subwatersheds have a higher percentage of stands in an early seral condition and higher drainage densities. According to Chow (1964) the higher drainage density the more complex the watershed and the faster streamflow will respond to rainfall. Runoff in these areas may occur sooner than in the Yellow Creek and Lost Canyon subwatersheds due to vegetative conditions and drainage densities (Table 3-4). A more detailed analysis of these subwatersheds is necessary to determine actual affects of early seral conditions on flow routing than the cursory information mentioned here.

2. Streamflow

Streamflow is currently being monitored at the Umpqua River near Elkton, Oregon. The drainage area of the gaging station is 3,683 square miles, and by definition, characterizes the flow of all streams draining this point. The streams and their attendant drainage areas represent only a small amount of the flow to the gage. Most of the streams are frontal to the Umpqua River and contribute approximately 10% of the flow to the gage for a given flood event. The flood frequencies for the Umpqua River near Elkton, Oregon are displayed in Table 5-4.

Table 5-4

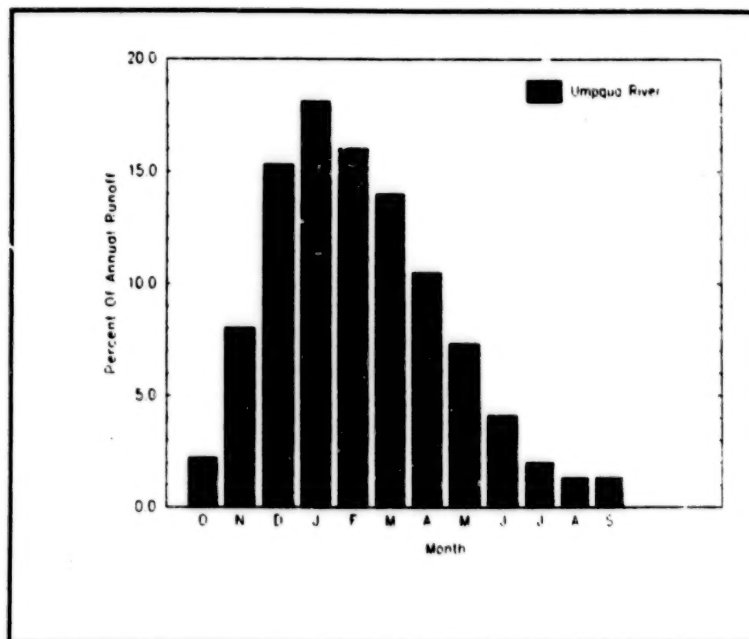
Magnitude and probability of instantaneous peak flow for Umpqua River near Elkton, Oregon. Station Number 14321000.							
Recurrence Interval (Years)	1.25	2	5	10	25	50	100
Annual Exceedance Probability	80	50	20	10	4	2	1
Umpqua River near Elkton	65300	96000	140000	170000	208600	237700	267000

Data from Moffatt et al. 1990.

For the period of record, the average annual flow is 7,510 cfs, and over 70% of the annual flow occurs from November through March 9 (Moffatt et al., 1990). Chart 5-9 below shows the percent annual runoff by month.

Chart 5-9

Monthly Runoff for Umpqua River near Elkton, OR



A review of annual peak flow data indicates that major regional floods have occurred on a regular basis since the turn of the century, most notably the 1964 100 - year flood. The recent flooding in November and December 1996 were ten-year events and caused significant property damage. Flow data has not been collected for frontal streams to the Umpqua river. Regional flood frequency equations for the Rogue-Umpqua were utilized to determine approximate floods for 2, 5, 10, 25, 50, and 100-year recurrence intervals (Table 5-5). Table 5-5 summarizes flood flows by drainages and not distinct watersheds, except Yellow creek. Flow characteristics will vary by subwatershed in the WAU due to topographic position, slope, and precipitation intensity from orographic effects.

Rosgen suggests the importance of determining the bankfull stage (recurrence interval of 1.5 years for the WAU) because channel maintenance is most effective at flows of this magnitude. The bankfull stage corresponds to the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels (Dunne and Leopold, 1978). It is this discharge concomitant with the range of flows that make up the annual hydrograph which govern the shape and size of the channel. An estimate of bankfull discharge can be determined by the equation:

$$Q_b = A^{0.75} \quad A = \text{drainage area}$$

3. Low Flows

Streamflows vary markedly from winter to summer in the southwestern Cascades as depicted by Chart 5-9. Only 2.6 percent of the annual flow occurs in August and September. In late summer, the average flow per square mile (csm) for August ranges between 0.2 - 0.5 csm, while the average csm in December is approximately seven times the summer range at 4 csm.

Low flows characteristics may vary depending on type of land units in certain catchments. Summer low flows in catchments with moist/warm land units are expected to be greater than in catchments with more dry/warm land units. Secondly, average soil moisture holding capacities can vary greatly from locale to locale. The soils with the highest soil water capacities have depths greater than 60 inches to bedrock, loamy and clayey textures, and are over soft bedrock. They are dominant in the alluvial deposits along the Umpqua and Elk Creek and in upland soils with slopes less than 60

percent. The soil depth map (Figure 6-7) describes where the deepest average depth of soils occur (green delineation). The highest average water holding capacities of upland soils occurs in the Elkton geologic formation (Figure 6-2) on page 6-10). The Geology-Topography-Soils Relationship section on pages 6-2 and 6-3 gives a more in-depth look on the subject. Water is routed to stream channels much quicker than the scenario above.

4. Peak Flows

An analysis of long term hydrologic records has demonstrated measurable changes in the timing and magnitude of winter peak flows that are associated with roads and harvesting. Recent research in Willamette River tributaries have documented detectable increases in peak flows in managed watersheds (Jones and Grant, 1996). An analysis of potential peak flow increases for the WAU has not been conducted.

For long term stability and extended use in a wet climate, roads have been constructed to efficiently drain water away from road surfaces and sub-grades. In the natural environment, there is nothing that mimics a road. The majority of roads in the WAU are constructed with ditches and/or in-sloped road surfaces that are intended to control water flow from the road surface, upslope overland flow, and groundwater that is intercepted and brought to the surface. Water reaches the channel faster than an un-roaded area via ditch-line flow, and effectively function as streams during rain storms. The same effect occurs where roads were built very close to streams, and outflow from cross drains erodes a gully and reaches a stream channel without infiltrating into the ground.

Wemple (1994) developed a process and investigated the effective extension of stream networks resulting from road drainage. She estimated that roads in her study area extended the stream network 60 percent over winter base flow stream lengths and 40 percent over storm event stream lengths. Her process has not been applied to this WAU, but efforts in Jackson creek Watershed found that the existing road system extended the stream network by 26 percent, based on winter base flow stream lengths. There will be significant differences in winter base flow stream lengths depending on road design characteristics, road surfacing, and the date it was constructed. The road densities range from 3.2 to 4.7 mi/mi² by subwatershed; however, not all roads have been mapped on GAS and actual road densities are probably higher. Elkton Frontal, Hancock, Lower Elk, Kellogg, Smith Ferry Frontal, and William Frontal have higher road and drainage densities. The stream crossings per stream mile are greater than the mean of 1.5 for the WAU. These factors combined can potentially increase runoff in the form of increased peak flows and greater increases in bankfull discharge. As was stated earlier, most of the work of stream erosion and deposition (over time) is done by flows of moderate magnitude (bankfull floods) with recurrence intervals of 1 to 2 years. Changes in bankfull stage of smaller streams may hinder the natural recovery of these streams by preventing aggradation and sorting of bed material, revegetation and stabilization of streambanks, and by reducing establishment of stable, regularly inundated floodplains adjacent to active channels.

The risk for potential peak flow increases by the potential channel extension was estimated by the number of stream crossing, stream density, and road density for the above frontal drainages. It was assumed that higher road and stream crossings, and therefore higher probability for greater hydrologic interaction with the stream network, would have the highest potential for peak flow increases from road-related runoff. A caveat to the assumptions above is that actual field data collection has not been conducted, and the number in GIS probably under represents road and stream lengths.

5. Riparian Function and Coarse Woody Debris

Riparian function is the interaction of various hydrologic, geomorphic, and biotic processes across a range of spatial and temporal scales within the riparian environment. In the context of watershed analysis, riparian function is defined here by two specific processes: 1) the recruitment of large woody debris to aquatic systems, and 2) the provision of shade to aquatic systems. The role of large woody debris as a critical factor affecting aquatic habitat for fish and other aquatic organisms has been heightened by recent research studies. Scientists originally viewed large debris jams as barriers to fish passage and wood was systematically removed across the landscape during the 1940s and 1950s. Several studies have shown that the loss or removal of woody debris from stream channels can result in significant changes in channel morphology, a loss of sediment storage capacity, and an increase in the rate of sediment transport (Beschta 1979; Bilby 1984; Heede 1985). The buffering capacity of wood is reduced leading to degradation of spawning gravels, filling in of rearing pools, and reducing invertebrate populations. The quality and quantity of wood reaching the stream will influence the morphological and biological functioning within the stream; such as creating and maintaining pools, forming eddies where food organisms are concentrated, reducing stream velocities and shear stress along banks, shelter during high flows, and trapping organic inputs from adjacent riparian areas.

The natural recruitment of coarse wood to streams can result from landsliding, fires, wind, and debris torrents. The delivery of coarse wood to downstream fisheries and aquatic life is affected by valley form, soil stability, tree species and age class, and the frequency of large flows over time. Low gradient streams tend to store large wood from upstream sources and headwater streams tend to be Rosgen A channels that transport coarse wood.

The size of wood necessary to interact with head water streams is less due to valley type, channel morphology, and flow conditions. Larger wood is necessary to interact with larger stream systems. For conifers, significant recruitment from a second-growth stand generally begins approximately 100 years after harvesting, with increasing rates of recruitment after this period.

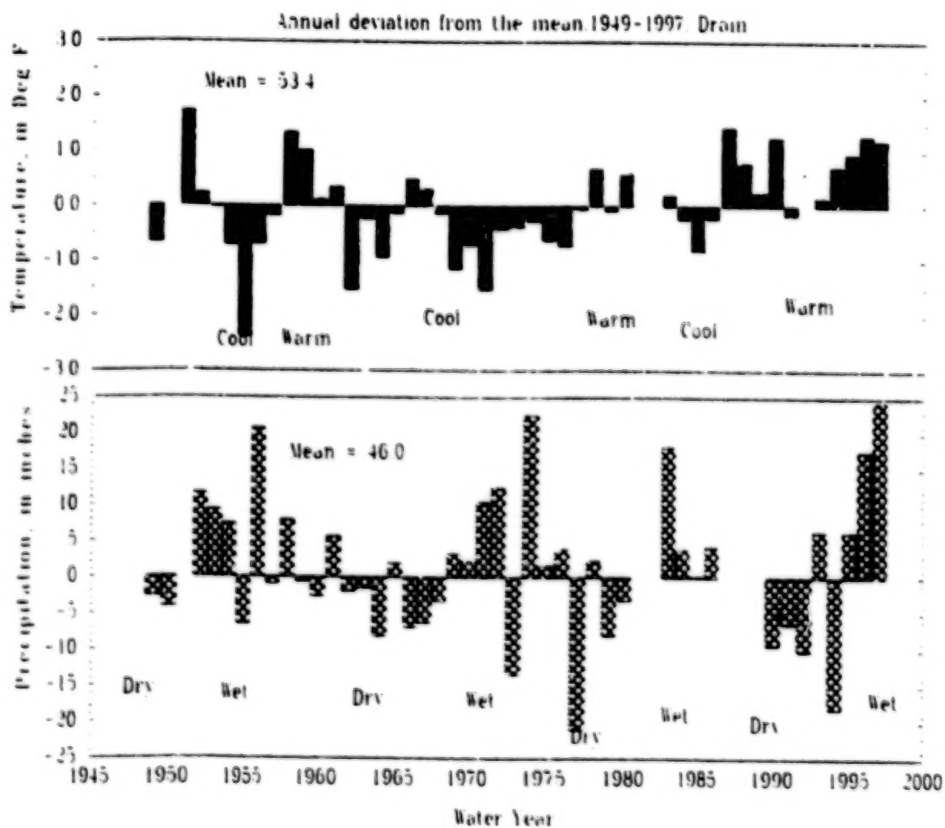
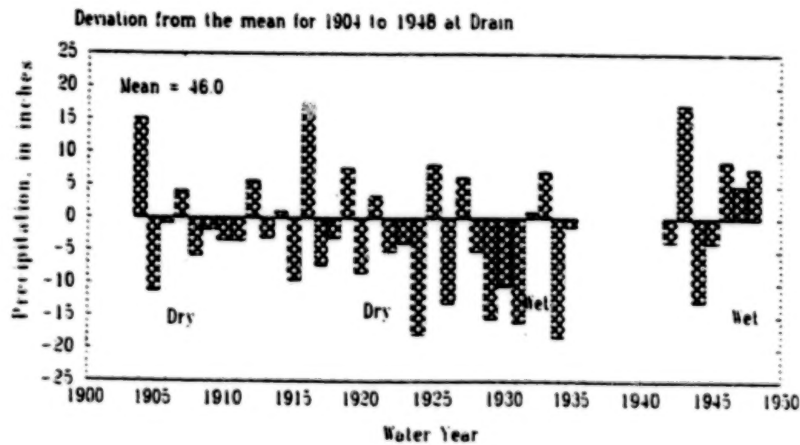
Two recent studies of riparian areas in Oregon have been conducted; one in the central Oregon coast range and the other in the McKenzie River drainage. Both studies concluded that riparian forest contained lower abundances of conifers in streamside forests than in adjacent upslope forests. In four stands (central coast Oregon) that were older than 90 years, the total conifer basal area was 65% of that estimated for upslope forests (Andrus and Froehlich, 1988). Of the 15 stands older than 20 years, all had greater basal area (ft^2/ac) and volume on upslope forests than that observed in riparian areas. However, the abundance of trees along riparian areas differs from reach to reach, and depends on the landform or valley type associated with a particular stream reach. In the McKenzie River drainage, the total conifer basal area for an old growth stand and a 125 year old stand were 75% and 71%, respectively of that noted in upslope forests. Conifers in riparian areas need to reach 150-200 years of age in order for streams to reach maximum production potential regarding biomass, biodiversity, and species richness (Gordon Reeves personal communication).

Studies of woody debris in Cascade Mountain streams measured rates of wood input in old growth forests and riparian tree mortality rates. The tree mortality rates required to generate wood loading rates are three to four times greater than mortality rates observed in upslope reference stands. The higher rates of mortality can be attributable to damage by floods, greater wind damage along the stream corridor, physiological stress is greater for trees growing on unsuitable microsites, steeper and less stable toe slopes, and greater lean of trees toward canopy openings along stream corridors.

The studies seem to suggest that there are less trees per acre in riparian areas than upslope areas due to the factors listed above. The studies were conducted in stands greater than 90 years of age. Commercial thinnings in the riparian reserve land use allocation (within this WAU) would occur in 30-80 year old stands that were found to be overstocked and low in structural diversity.

Chart 5-2.

Weather Station at Drain, Oregon Lat. 4340N Long. 12319W at an elevation of 292 feet



ELKTON-UMPQUA WAU
Road Densities, Drainage, Stream Crossings

Table 5-2

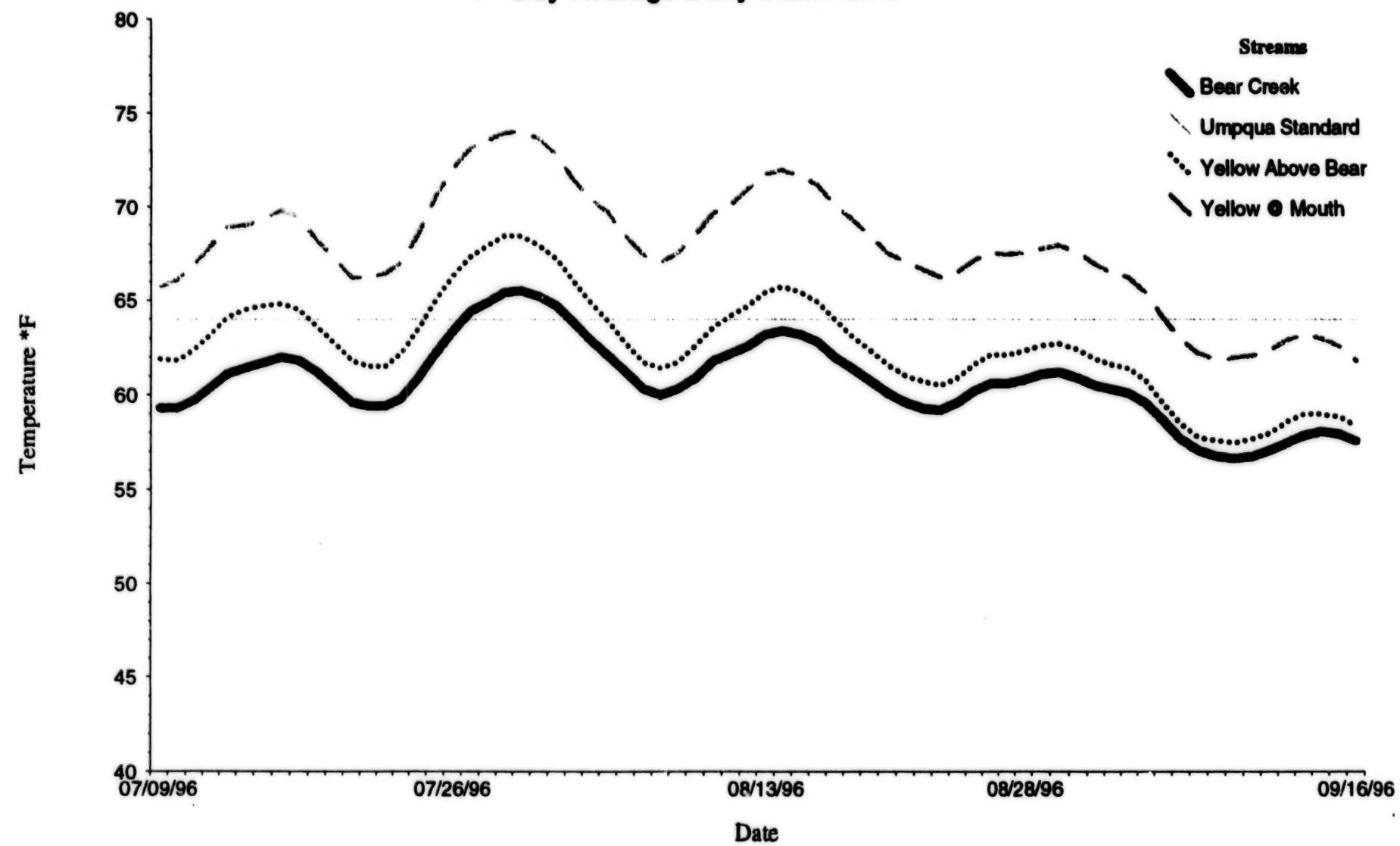
Drainages Subwatersheds	Area (Acres)	Area (Sq Miles)	Total Road Length (BLM, Miles)	Road Density (BLM) (Miles/Sq Mi)	Total Road Length (Non-BLM, Miles)	Road Density (Non-BLM) (Miles/Sq Mi)	Total Road Density (Miles/Sq Mi)	Total Stream Length (Miles)	Road/Stream Crossings (Potential Culvert #s)	
									BLM	Non BLM
Elk Overpass	2912	4.6	5.6	1.2						
Elkton Frontal	1897	3.0	2.5	0.8	11.5	2.3	3.8	28.6	10	21
Hancock	2544	4.0	2.9	0.7	16.6	5.6	6.4	19.7	3	46
Little Tom	3657	5.7	0	0	18.3	4.6	5.3	24.9	9	34
Lower Elk	1585	2.5	1.7	0.7	12.5	2.2	2.2	33.9	23	21
Elkton	12595	19.7	12.7	0.6	12.1	4.9	5.6	16.9	1	37
Bullock Bridge	594	0.9	0.6	0.6	71	3.6	4.3	124.0	46	159
Little Canyon Creek	4664	7.3	11.6	1.6	5.8	6.2	6.9	3.8	0	6
Lost Canyon	5059	7.9	9.5	1.2	15.7	2.2	3.7	19.3	7	9
Tyee Rec	2627	4.1	2.7	0.7	6.7	0.8	2.0	20.9	3	6
Lost Canyon	12944	20.2	24.4	1.2	11.6	2.8	3.5	16.4	3	11
Deep Gulch	2725	4.3	2.7	0.6	39.8	2.0	3.2	60.4	13	32
Hutchinson Wayside	2495	3.9	1.1	0.3	16	3.8	4.4	16.3	9	18
Kellogg	4844	7.6	1.9	0.3	11.1	2.8	3.1	19.8	2	13
Martin Creek	2542	4.0	8.3	2.1	37.3	4.9	5.2	49.1	1	103
McGee Creek	3547	5.5	10.1	1.8	4.1	1.0	3.1	23.1	18	5
Waggoner Creek	3884	6.1	11	1.8	14.7	2.7	4.5	19.5	8	18
McGee Creek	20037	31.3	35.1	1.1	22.7	3.7	5.6	23.8	11	17
Brads Creek	4109	6.4	13.4	2.1	105.9	3.4	4.5	151.6	49	174
Fitzpatrick Creek	2094	3.3	4.9	1.5	14.9	2.3	4.4	20.7	38	37
Heddin Creek	2695	4.2	6.5	1.5	8.1	2.5	4.0	10	3	3
Mehl Creek	5803	9.1	16.9	1.9	15	3.6	5.1	15.8	0	27
Phipps Point	2148	3.4	0	0.0	11.4	1.3	3.1	31.4	7	21
Smith Ferry Frontal	7613	11.9	0.9	0.1	15.9	4.7	4.7	17.8	0	38
William Frontal	6559	10.2	4.3	0.4	61.2	5.1	5.2	67.1	0	115
Mehl Creek	31021	48.5	46.9	1.0	54	5.3	5.7	65.9	6	120
Bear Doe	3276	5.1	9.4	1.8	180.5	3.7	4.7	228.7	54	361
Lower Yellow	4192	6.6	14.5	2.2	4.5	0.9	2.7	27.6	7	11
Upper Yellow	6075	9.5	17.1	1.8	11.5	1.8	4.0	18.4	11	4
Yellow Creek	13543	21.2	41	1.9	12.9	1.4	3.2	42.4	15	23
TOTAL WAU	90140	140.8	160.1	1.1	426.1	3.0	4.2	653.1	195	764

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Elkton - Umpqua WAU Stream Temperatures

Chart 5-3

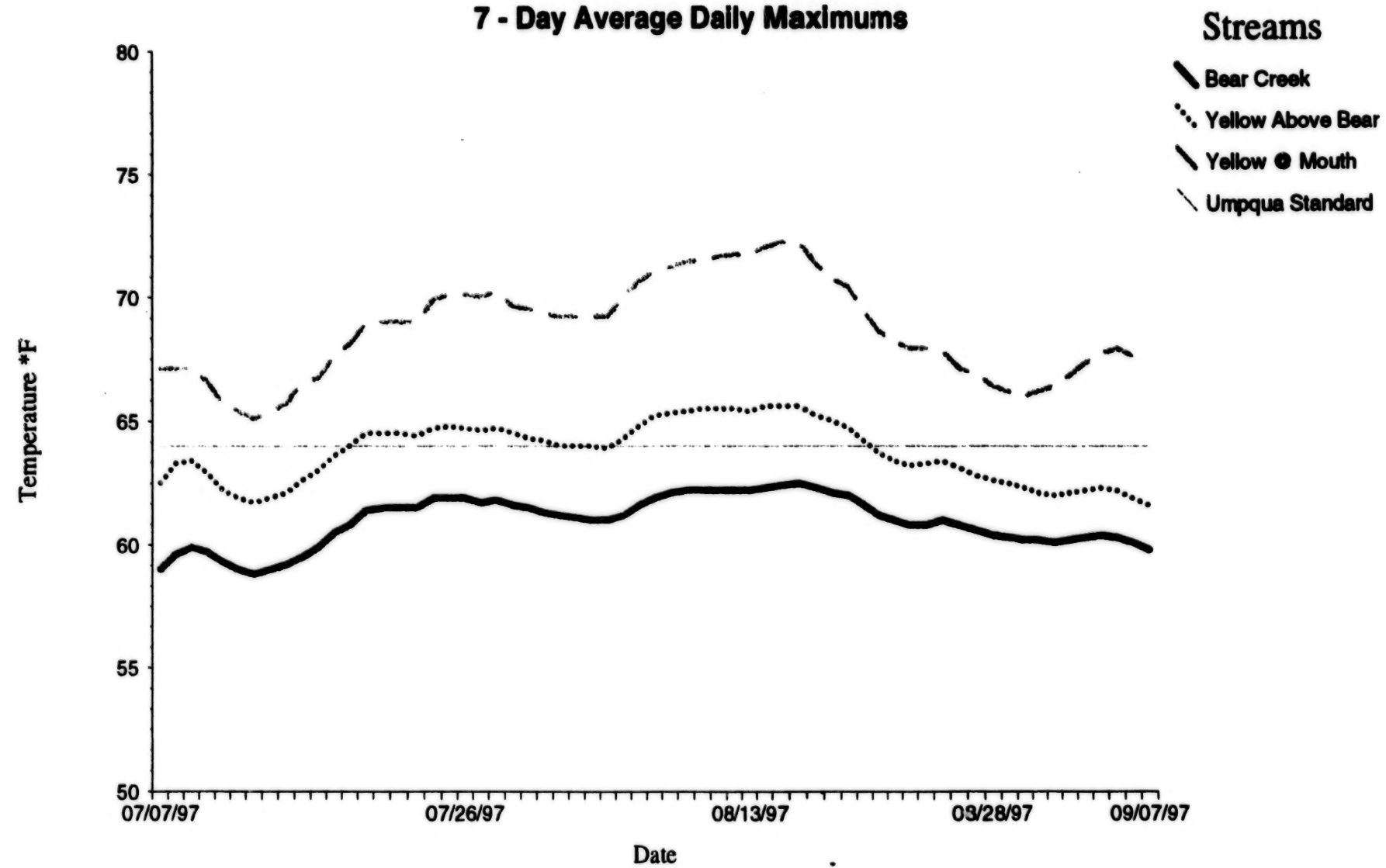
7 - Day Average Daily Maximums



64 °F is the Umpqua Basin Temperature Standard

Elkton - Umpqua WAU Stream Temperatures **7 - Day Average Daily Maximums**

Chart 5-4

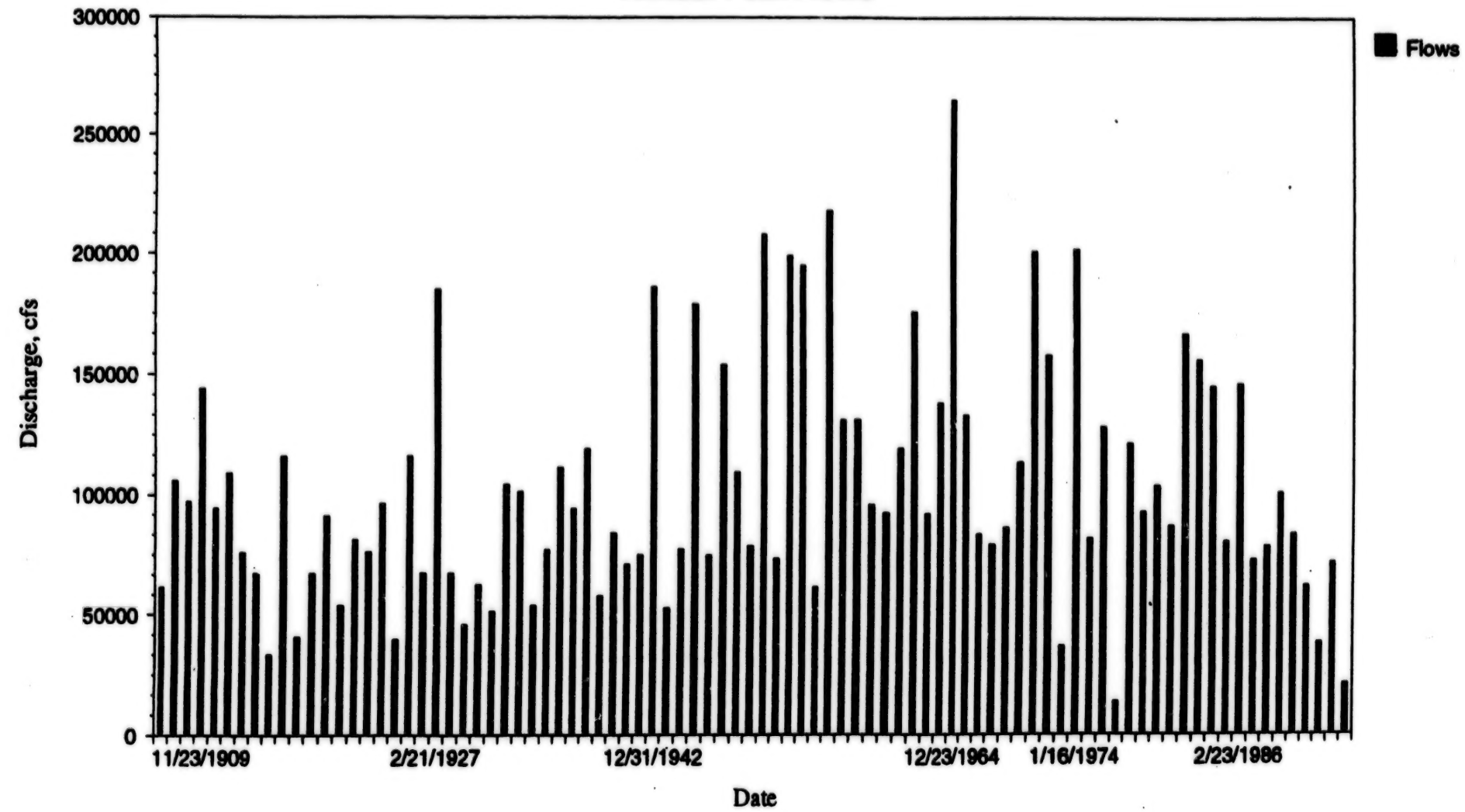


64 *F is the Umpqua Basin Temperature Standard

Umpqua near Elkton, OR Gauging Station

Chart 5-5

Annual Peak Flows



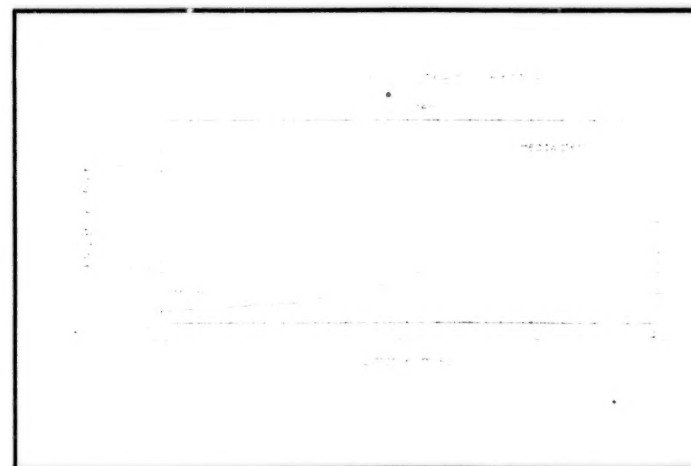
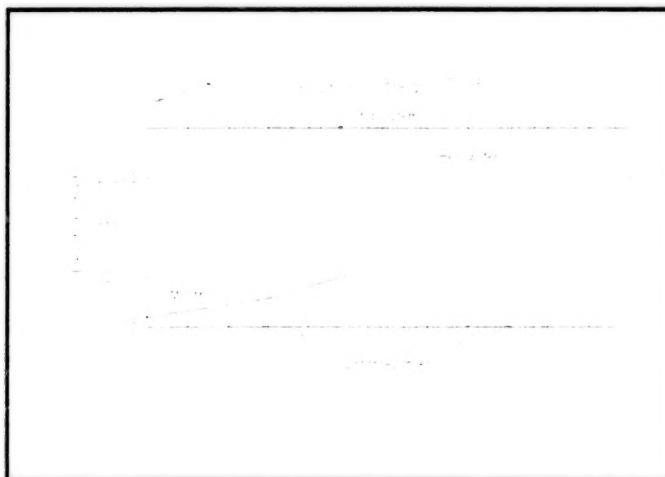
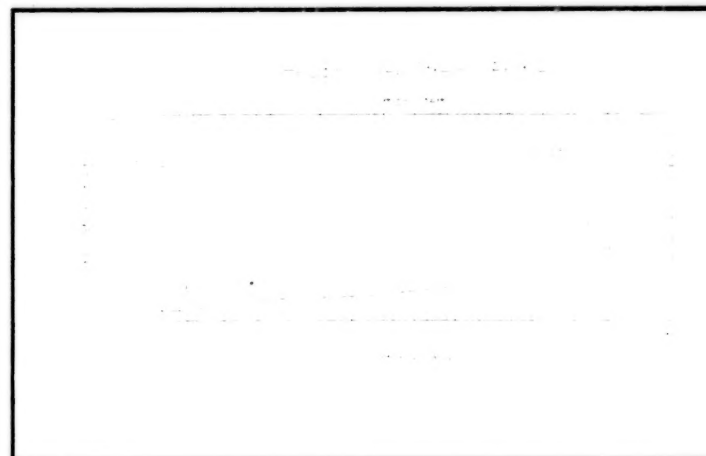
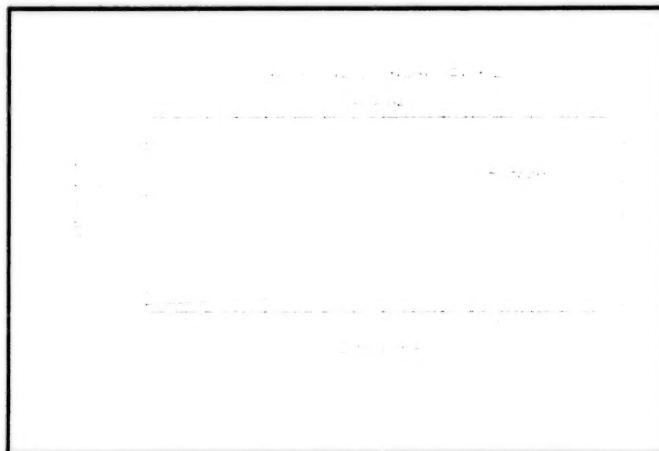
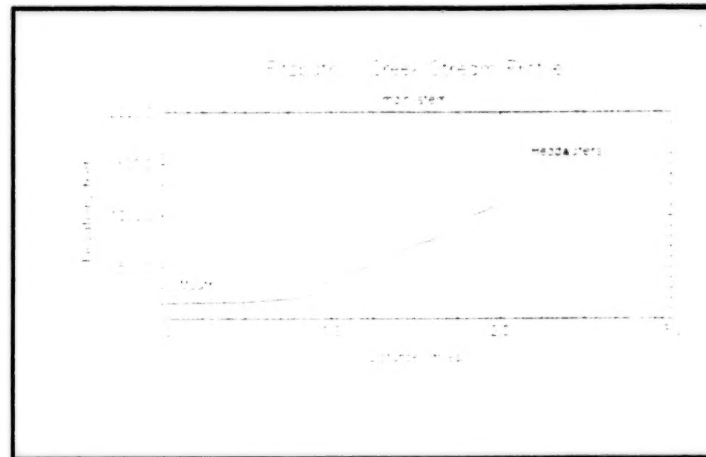
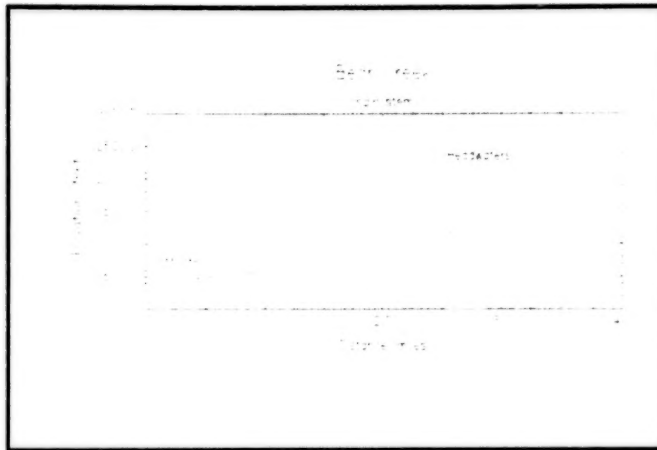
Regional Flood Frequency Equations.

Table 5-5

Magnitude and probability of instantaneous peak flow. Area is the drainage area of the drainage. Discharge in ft ³ /s for indicated recurrence interval, in years and annual exceedance probability, in percent. Range of peak flow in ft ³ /s per mi ²								
Drainage	Area, mi ²	I, inches	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
Little Tom Folley	5.7	3.5	457	703	864	1089	1267	1432
Elk Overpass	4.6	3.5	380	582	716	900	1045	1181
Elkton Frontal	3.0	3.5	263	400	491	615	711	804
Lower Elk	2.5	3.5	225	340	419	523	604	682
Hancock	4.0	3.5	337	515	633	795	921	1041
Smith Ferry Frontal	11.9	3.5	860	1344	1652	2098	2458	2778
Phipps Point	3.4	3.5	293	446	548	688	796	900
Hedding Creek	4.2	3.5	351	538	661	830	963	1088
William Frontal	10.2	3.5	753	1174	1442	1829	2140	2418
Brads Creek	6.4	3.5	504	779	957	1208	1406	1590
Fitzpatrick Creek	3.3	3.5	285	424	534	670	775	876
Mehl Creek	9.1	3.5	683	1061	1304	1652	1931	2182
Waggoner Creek	6.1	3.5	484	746	917	1157	1347	1522
Hutchison Wayside	3.9	3.5	343	504	619	777	901	1018
McGee Creek	5.5	3.5	443	682	838	1055	1227	1387
Deep Gulch	4.3	3.5	358	549	674	848	983	1111
Martin Creek	4.0	3.5	337	515	633	795	921	1041
Kellog	7.6	3.5	585	906	1113	1407	1642	1856
Yellow	21.2	3.5	1413	2234	2746	3507	4133	4672
Tyee Rec	4.1	3.5	344	526	655	812	942	1065
Bullock Bridge	0.9	3.5	93	138	170	211	241	272
Little Canyon Creek	7.3	3.5	565	874	1088	1358	1552	1790
Lost Canyon	7.9	3.5	604	937	1152	1457	1700	1921

I = 2yr 24 hour precipitation intensity derived from NOAA - Precipitation-Frequency Atlas of the Western United States, 1973.

Note: Standard errors in the flood frequency equations are 41-50 %.



Elkton - Umpqua WAU Stream Profiles

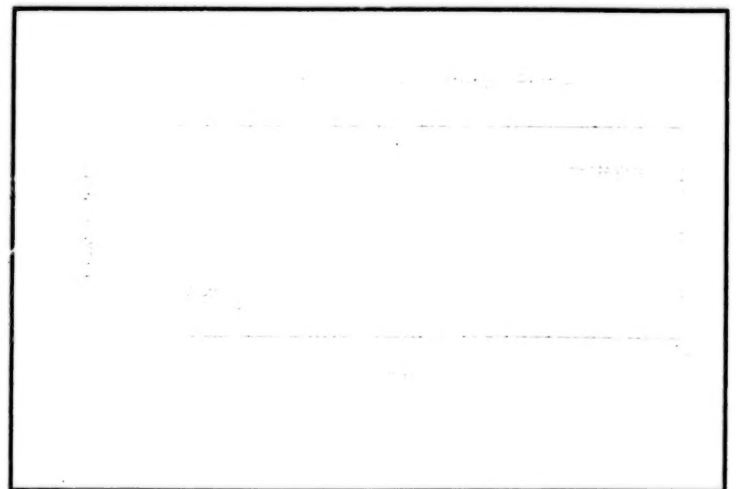
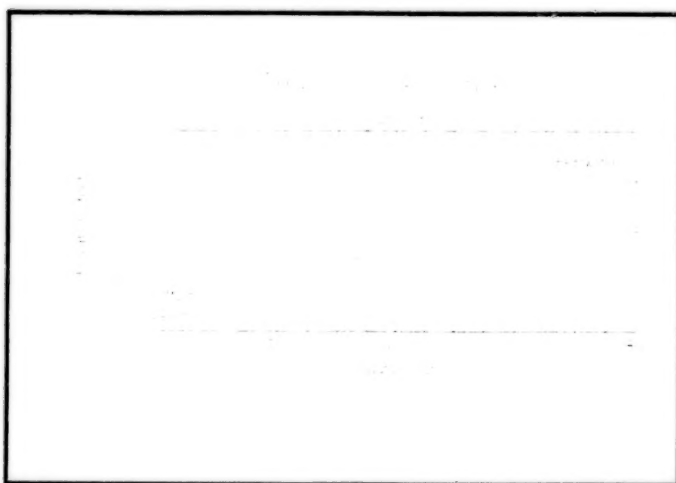
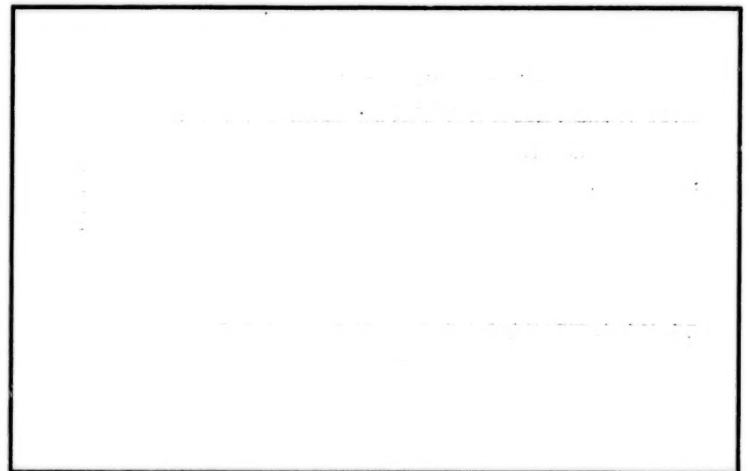
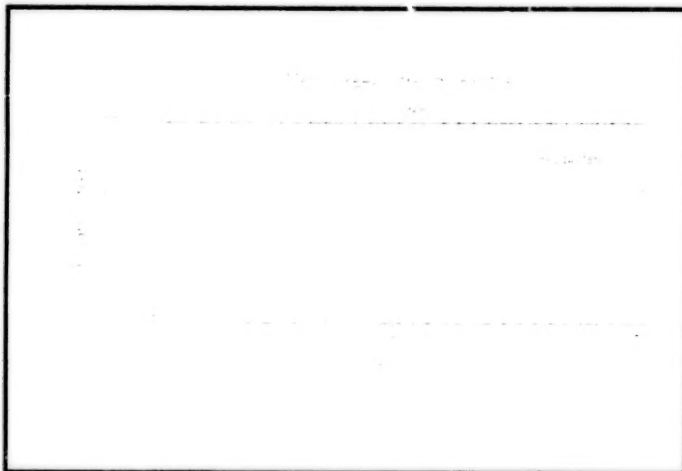
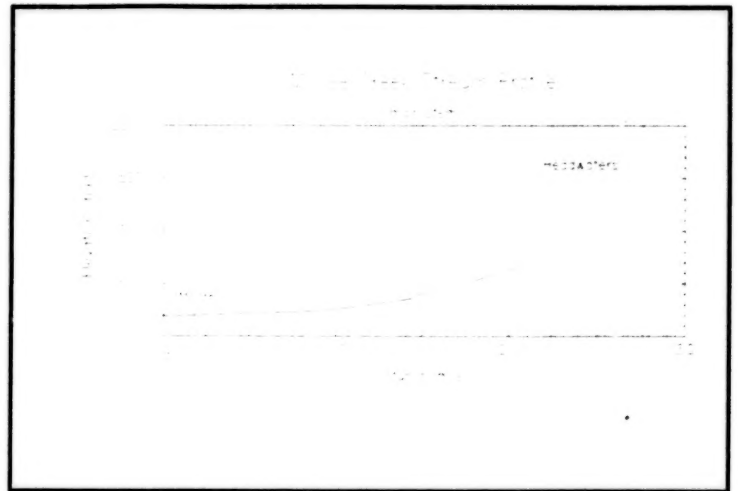
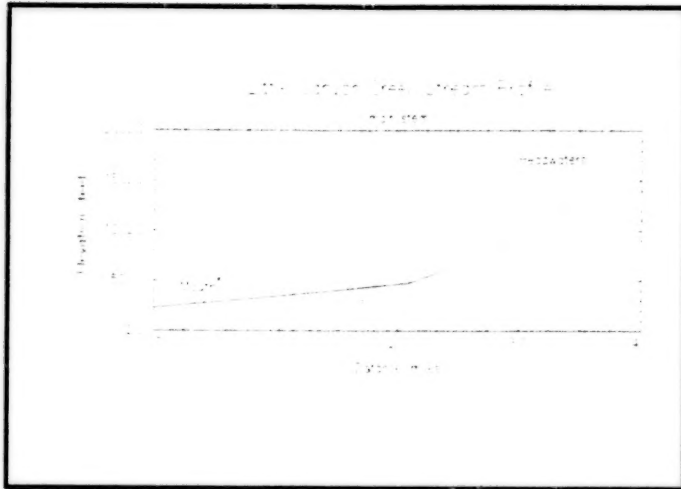
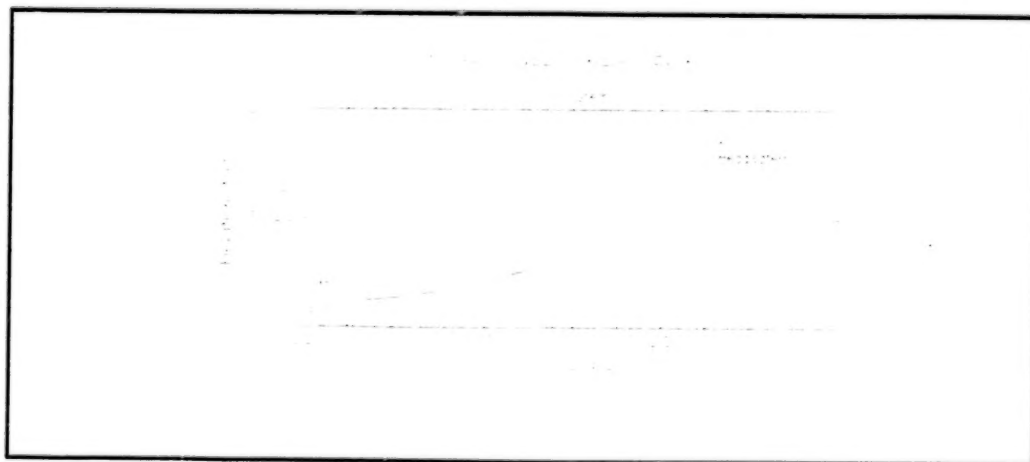
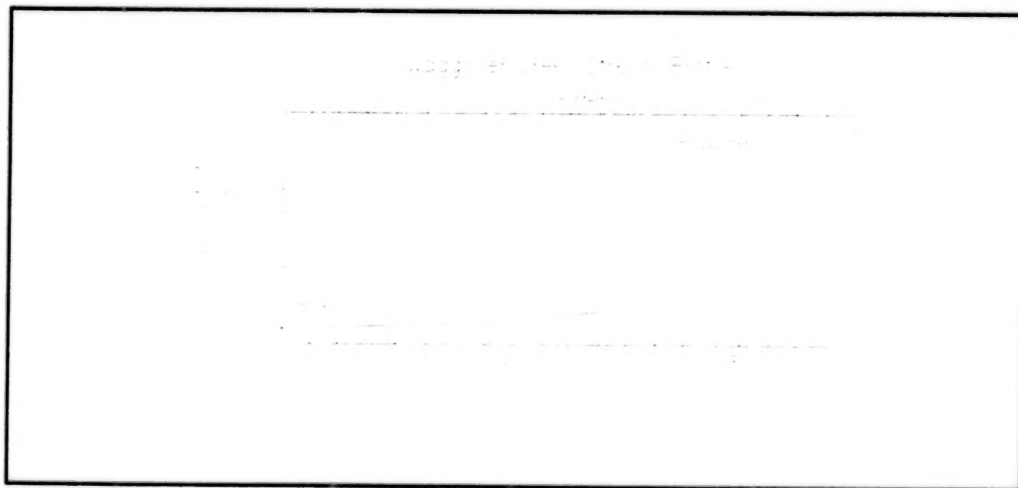
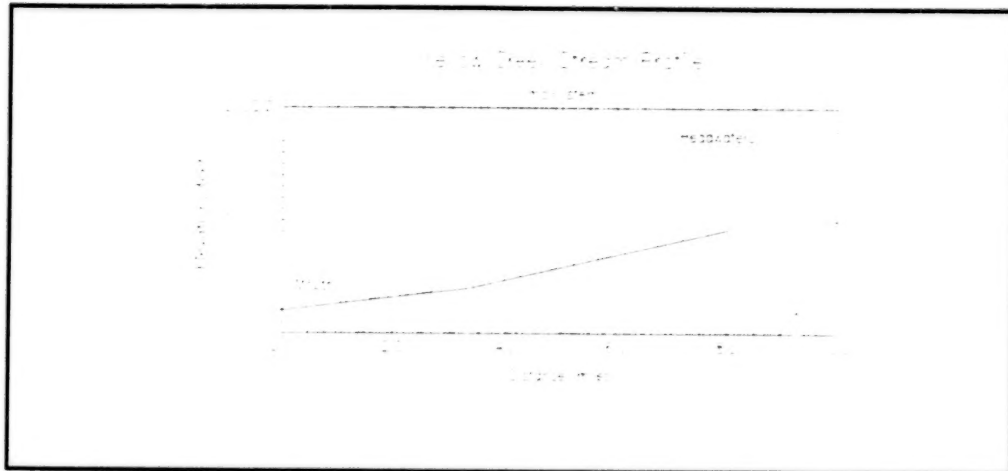


Chart 5-8.

Elkton - Umpqua WAU Stream Profiles



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GEOLOGY, SOILS and STREAM CHANNELS

A. Characterization

1. Topography and Geology

Elkton-Umpqua WAU is situated in the Coast Range Geographic Province and has highly variable topography. It ranges from broad floodplains and terraces along the Umpqua to very steep, highly dissected terrain. Figure 6-1 and Table 6-1 give a good overview of slope distribution. It and other soils maps in this report were compiled from various combinations of soil mapping units from the Natural Resources Conservation Service Douglas County Soil Survey.

Elevations range from 80 feet on the Umpqua River at Elkton to 2600 feet at the very southern tip of the WAU on Tyee Mountain. Local relief varies from 600 to 1600 feet. Above 2000 feet is considered the transient snow zone. About 6500 acres or 7.2 percent of the WAU occurs in the transient snow zone. Locations above 2000 feet are:

The heads of Waggoner Creek and a major tributary of Mehl Creek in the west end of the WAU (540 acres)

The head areas of Little Canyon and Lost Creeks in Sections 30 and 31, T24S, R6W and Sections 25 and 36, T24S, R7W (2930 acres)

The SW segment of Yellow Creek Mountain in Sections 9 and 17, T24S, R6W (250 acres)

Broken Buck Ridge, Yellow Butte and Prince Albert forming the northern rim of the Yellow Creek watershed (2810 acres)

Seven geologic units occur within the WAU as mapped in Compilation Geologic Map of the Southern Tyee Basin, Southern Coast Range, Oregon by Alan and Wendy Niem, 1990.

GEOLOGIC UNITS

Table 6-2

GEOLOGIC UNIT	ACRES	PERCENT of AREA
Bateman Formation	3,683	4.1%
Elkton Formation	22,659	25.1%
Siuslaw Member of the Flourney Formation	3,929	4.4%
Roseburg Formation (outer fan and fan fringe facies)	267	0.3%
Tyee Formation	50,179	55.7%
Quaternary Alluvium	6,550	7.3%
Landslide Debris	961	1.1%
Water	1897	2.1%

The geologic formations are comprised of varying sequences of sandstone and siltstone sedimentary rocks. Much of the rugged terrain is attributable to the erosion resistance of many of the sandstones. These formations are shown in Figure 6-2 and are briefly described below.

Teb = Bateman Formation(middle Eocene): Thick-bedded to cross-bedded, medium grained micaceous arkosic sandstone and minor siltstone; locally bearing subbituminous coal and carbonaceous siltstone. Many sandstone beds massive to cross-bedded. Deltaic and shallow marine unit, approximately 1500 feet thick.

Tee = Elkton Formation(middle Eocene): Micaceous siltstone with thin to thick sandstone lenses and rhythmically

interbedded thin graded micaceous sandstone and siltstone. Some thicker bedded to cross-bedded better sorted sandstone near the top of the formation. The unit is approximately 3000 feet thick.

Tef, = Siuslaw member of the Flourney Formation(lower to middle Eocene): Four to five thousand feet of very thick-bedded, massive to graded fine-grained micaceous amalgamated lithic-feldspathic sandstone with minor sequence of thin-bedded siltstone and fine to very fine-grained graded sandstone beds and some very thick-bedded channelized sandstone. A few beds are slump folded.

Tet, = Undifferentiated Tyee Formation of Baldwin(1974)(middle Eocene): Five to six thousand feet of well-indurated, thick to very thick-bedded cliff forming, micaceous arkosic sandstone and thin-bedded siltstone. Molenaar (1985) maintains that Flourney and Tyee formations can not be differentiated and that the two units should be mapped as Tyee.

Tet, = Tyee Mountain member of the Tyee Formation (Baldwin 1974) (middle Eocene): Fifteen hundred feet of thick-bedded fine to coarse-grained locally graded to massive micaceous lithic-arkosic sandstone and thin layers of siltstone; cliff former; grades upward into the Hubbard Creek member.

Tet, = Hubbard Creek member of the Tyee Formation(Baldwin 1974)(Middle Eocene): Mainly dark gray, parallel mudstone and siltstone with minor thin to medium beds of fine-grained micaceous sandstone; 400 feet thick of slope former.

Ter, = Outer Fan and Fan Fringe Facies in the Roseburg Formation of Baldwin(1974)(Paleocene to lower Eocene): thin, even-bedded very fine-grained to medium grained graded lithic sandstone and siltstone.

Qal = Quaternary Alluvium (Holocene and Pleistocene): Floodplain and stream channel sediments composed of clay, silt, sand and gravel; includes fluvial terrace deposits.

Qls = Landslide Debris(Holocene and Pleistocene): Chaotic mixture of gravel, sand, silt and clay with blocks of weathered bedrock of varying composition(mostly sandstone and mudstone). Only areas of approximately one square mile or larger are shown due to the small scale(1:125,000) of the Niems map from which map#1 was derived.

Renewed underthrusting of the Pacific plate near the close of the Eocene(about 38 million years ago) caused mild folding and tilted fault blocks (monoclines) in these formations to appear on the landscape. The uplift has continued to the present. The dip of the rock strata throughout the WAU is variable, being predominantly to the southwest in the north, predominantly northwest to northeast in the west central region and predominantly west to northwest in the east and south regions. The angle of the dip generally varies from 5 to 20 degrees with it reaching as high as 50 degrees in small areas.

2. Geology-Topography-Soil Relationships

The discussion in the following paragraphs contain the viewpoints of the soil scientist based on field observations and the patterns discerned on topographic maps. The direction of the dip of the rock strata may have had a great influence on the evolution of the topography and soils following the onset of the late Eocene underthrusting of the Pacific plate. At the very least there seems to be a strong correlation between the direction of the dip and topographic patterns.

The most striking pattern for the Bateman, Flourney and Tyee Formations is the alternating in a closely parallel fashion of steep to very steep (60 to 90 percent slopes), generally deeply dissected terrain with gentle to moderately sloping(typically 10 to 60 percent), generally less deeply dissected terrain. These alternating terrains are separated by the more major ridgelines or ridgenoses and second or higher order streams.

The slope orientation of the gentle to moderately sloping terrain closely matches the direction of the dip. Very to extremely steep scarps may at intervals break up this gentler terrain. These scarp features may be fault block or slump features. Slump-earthflow processes may have been one of the important forces in the formation of topography here. Excluding the scarps and inner gorges, the soils overall are deeper, less gravelly and more clayey. The bedrock is characteristically soft or somewhat hard and brittle. It tends to weather rapidly when exposed. Figures 6-3 and 6-4 illustrate this discussion as well as the paragraph below.

The slope orientation of the steep to very steep, highly dissected terrain tends to be closely aligned with the opposite

direction of the dip. The dissection is often in the form of small side canyons. Small areas of extremely steep slopes in excess of 90 percent exist. Shallow translational slides and torrents seem to have been a major force in the formation of the topography here. The soils are overall shallower, more gravelly and less clayey. The sandstone bedrock mostly ranges from weakly cemented, somewhat hard and brittle to very hard and well indurated. Thin layers of soft and crumbly very fine sandstone along with siltstone may be interbedded. Ledge rock outcroppings are locally common especially where thick strata of well indurated sandstone exist. In areas where the dip is variable within short distances, the dip-topography relationship is less distinct or not discernible.

This dip-topography relationship seems to hold up well where there are sequences of thick sandstone bedrock with only minor interbedding of siltstone. In the Elkton Formation thick sequences of siltstone with minor interbedding of sandstone is the rule and consequently this relationship only holds up for a small percentage of the area. Here the most common pattern, regardless of slope orientation with the dip, is the predominant gentle to moderate slopes (10 to 60 percent) broken at intervals with short steep to very steep scarps and the over-steepened gorges of the more major streams. There are small areas of relatively thick sequences of sandstone which cap the Elkton Siltstone. This gives a landscape similar to the Bateman, Flournoy and Tyee formations for a short interval. Figures 6-5 and 6-6 illustrate this discussion.

Knowing this dip-topography relationship may be most important in predicting certain high probability locations of slope instability for general planning or initial project scoping.

Soil depth is an important characteristic for vegetation, hydrology and slope stability. The site index is lower for the shallower soils. Very shallow soils over non fractured bedrock will not support trees. The deeper more clayey soils have high water storage capacities. Very deep clayey soils may be subject to slump movements under certain conditions. The deeper, loamy soils on the steeper slopes are at greater risk for shallow translational landslides than the shallower soils on the same slopes. Soil depth is mapped in Figure 6-7.

Soil drainage is another important characteristic. Hydrophytic vegetation is found in abundance on poorly and somewhat poorly drained soils. These sites could qualify as wetlands and are shown in Figure 6-8. The majority of poorly and somewhat poorly drained soils in the WAU are concentrated in the floodplains and terraces along the Umpqua River and Elk Creek. Other large concentrations are along a segment of Heddin Creek (Sec. 34, T22S, R8W and Sec. 3, T23S, R8W), Little Canyon Creek and tributary (Sec. 19, 29 and 30, T24S, R6W).

3. Surface Erosion and Mass Wasting

The dominant erosion process under natural conditions has been landslides and subsequent erosion of the scars, soil creep and dry ravel encroaching on drainages and stream channel/bank alterations due to high flows associated with intense storm events. Sheet erosion resulting from periodic hot fires probably contributed a high percentage of the sediments reaching streams. Historically these processes have been accelerated most notably by roads, timber harvesting, livestock grazing and agriculture.

Table 6-3 below was adapted from one printed in the Coos Bay District's Upper Middle Umpqua Watershed Analysis which covers portions of subwatersheds within the Elkton-Umpqua WAU to the west.

Dominant Erosion Processes and Their Locations

Table 6-3

Erosion Process	Location
Debris avalanches and debris torrents	Most commonly occur in the Bateman, followed by the Flournoy and Tyee Formations. The most common points of origin within these formations are the steeper slopes of headwalls, hollows and swales. These slides commonly occur in the Elkton Formation where there are steep scarps, inner gorges and remnant sandstone cappings. Some of these scarps with slides identified in the aerial photos could be associated with ancient deep-seated slumps.
Recent-deep seated failures: rotational slumps and earth flows.	in the Elkton Formation where soils are deeper and in the deeper soils of the Bateman, Flournoy and Tyee Formations especially where slopes are in alignment with the dip of the rock strata. The occurrence is not too common. Some of these failures identified on the aerial photos may be smaller slides within ancient deep-seated slumps.
ancient deep-seated slumps	None have been identified on the ground but the most likely locations would be the Elkton Formation and then in the Bateman, Flournoy and Tyee Formations where slopes are in alignment with the dip of the rock strata. Within these large features, small debris avalanches on the scarps, and small deep-seated failures elsewhere (particularly on the slumps toe) occasionally occur.
Periodic erosion processes	Channel and stream bank erosion from flows of high intensity storms. Sheet erosion and ravel from hot fires
Chronic erosion processes	Soil creep occurs to varying extent throughout the WAU. Fine sediment bleeding into streams might be occurring where streams pass through deep-seated failures. Surface erosion is associated with unvegetated cuts, fills, ditches, unsurfaced road surfaces, and where activities expose bare soil. The deeper soils over thick beddings of siltstone would be the most sensitive sites (primarily the Elkton Formation), followed by other deeper soils.

B. Landslide Inventory and Analysis

A landslide inventory was done from aerial photography. Time constraints did not allow for any followup field work for this iteration. The Swiftwater Resource Area has aerial photo coverage of nine flights from 1959 to 1995. All of these flights give only partial coverage of the WAU. We only have one flight line for the 1995 flight that covers only the SE corner of the Magee Creek division. There is poor coverage for the 1959 (30 percent) and 1964 flights. All of the flights to varying degrees miss the western part of the Mehl Creek division. Much of the analysis does not use the landslides seen in the 1959 photos. Some of the analysis attempts to extrapolate to areas with no coverage for the period of 1959 to 1994.

Another limitation of the inventory is the ability to detect small landslides less than 0.1 acre. This inventory most likely under estimates these smaller landslides. Consequently much of the analysis only considers the landslides larger than 0.1 acre. Also landslides under forest canopies greater than 20 years of age are way under estimated so only management related landslides are addressed in the analysis except to mention where some of the exceptional natural landslides within the forest occurred. The details about how the inventory was conducted and its major limitations are covered in more detail in the appendix. Also in the appendix are tables which numerically tabulate the data in different ways.

1. Landslides by Geology, Topography, and Climate

Four hundred ninety-four (494) landslides were mapped covering the period from about the mid 1950s to the summer of 1994. Two large landslides were seen on the very limited coverage of the 1995 aerial photos. The upper watersheds of Little Tom Folly, Mehl and Waggoner Creeks have had a particularly high incidence of landslides and a high percentage of the larger slides.

Geologic Formations**Table 6-4**

Formation	acres	slides/1000 acres
Bateman	3,683	12.6
Flournoy	3,929	7.1
Tyee	50,179	6.9
Elkton	22,659	4.6
Roseburg	267	3.7
Landslide debris	961	1.8
Recent alluvium	6,550	0.2

The Bateman, Flournoy and Tyee Formations have a relatively high incidence of landslides, partially because of the high percentage of steeper slopes. The Bateman Formation might have a higher incidence of landslides than the Flournoy and Tyee because it has younger, less consolidated and cemented rocks and many of its beds exhibit cross-bedding. Shallow translational slides are most common on these three formations.

The Elkton Formation has a considerably lower percentage of the steeper slopes. Where there are concentrations of steeper slopes (primarily pitch scarps and inner gorges of streams) the incidence can be just as high the Bateman, Flournoy and Tyee. The higher percentage of deeper clayey soils over siltstone make the Elkton more subject to deep-seated slumps and earth flows than the other formations.

Table 6-5 gives the topographic position where the slides originated. Seventy-three percent of the landslides occurred on slopes which tend to converge and concentrate drainage. Caution: Many of the slides were difficult to place into a particular category (See limitations section in appendix.).

Topographic Position**Table 6-5**

Topographic Position	Landslides	
	Number	Percent
Headwalls	106	21.5
Swales or Channels	141	28.5
Concave slopes	111	22.5
Straight or Convex slopes	136	27.5
Total	494	100.0

Table 6-6 gives the landslide type. For many landslides there was a gray area as to whether they were more properly classified as debris avalanches or earth flows. Consequently the two were combined.

Type of Landslide**Table 6-6**

Landslide Type	Landslides	
	Number	Percent
Torrents	88	17.8
DA/EF* -Torrent Combinations	52	10.5
Debris Avalanches or Earth Flows	347	70.2
Slumps	7	1.4
Total	494	100.0

*DA = Debris avalanches

EF = Earth flows

Table 6-7 gives the deviation of precipitation from the average precipitation for the weather station at Drain. Figures are given on a yearly basis and for the period covered by each aerial photo flight. The data was compiled from Chart 6-1.

Climatic Data**Table 6-7**

Period	Precipitation		
	Deviation from Average for period(inches)	Years deviation is greater than 10 inches above average	Years Deviation is greater than 10 inches below average
7/53 to 7/59	+4.5	1 out of 6yrs	0 out of 6yrs
7/59 to 7/64	-1.6	0 out of 5yrs	0 out of 5yrs
7/64 to 8/70	-1.5	0 out of 6yrs	0 out of 6yrs
8/70 to 5/78	+2.7	3 out of 8yrs	2 out of 8 yrs
5/78 to 5/83	missing data	1 out of 3yrs plus 2yrs missing data	0 out of 3 yrs plus 2 yrs missing data
5/83 to 6/89	missing data	0 out of 3 yrs plus 3yrs missing data	0 out of 3 yrs plus 3 yrs missing data
6/89 to 7/94	-7.4	0 out of 5 yrs	2 out of 5yrs
7/94 to 7/97	+16.0	2 out of 3 yrs	0 out of 3 yrs

2. Landslide Numbers and Size

Refer to Chart 6-2 and 6-3 and Table A in the appendix for the following discussion.

Definition of terms (Landslide size was determined by slope area and not map area.):

small = less than 0.2 acres

medium = 0.1 to 0.5 acres

large = 0.5 to 2.0 acres

very large = 2.0 to 5.0 acres

extremely large = greater than 5.0 acres

Landslide numbers were relatively high up until 5/83. The 5/78-5/83 period had the highest average number of landslides per year but the 7/64-8/70 period had the greatest acreage in landslides. Road construction and harvesting was extensive in the fifties and sixties and the practices overall were more impacting back then. These were big factors in the relatively high incidence of landslides even though from 7/59 to 8/70 precipitation amounts did not deviate too much from the average and had more below average than above average years. Storm intensities would need to be researched to have a good picture. The December 1964 storm may have been one such storm but it is unclear how strong it was this far north. The effects of the storm in the WAU seems to be of considerably less magnitude than further to the south in Hubbard Creek, Cougar and Little Wolf Creeks where rain on snow could have been a factor.

The period of 8/70 to 5/78 saw a fair drop off of landslide activity even though there were three years with deviations of 11, 13 and 23 inches above the average. These could be explained by a trend in less road construction and harvesting. Activity was high in the Little Tom Folly watershed for this period.

There is a good upward spike in landslide numbers for the 5/78 to 5/83 period which correlates well with the big precipitation spike of 1982-83 precipitation year.

There is a big drop off in landslide numbers and size entering the 5/83 to 6/89 period. This trend might correlate to relatively low road construction (most arterial systems already built), relatively low timber harvesting, the onset of better road construction techniques including the avoidance of sidecasting on steep slopes, more road ridgetop locations and pretty average precipitation.

This downward trend continued through the 6/89 to 7/94 period to considerably low levels as drought dominated the climate and management activity remained relatively low.

1994 to 1997 saw a big turnaround to wet years with high intensity storms and an increasing upward trend in road construction and harvesting as second growth stands on private are clearcutted. There has been an upsurge in landslide activity. The extent is unknown because of a lack of aerial photo coverage.

3. Landslide Runout Distances

Runout lengths for the landslides mapped varied from less than 100 feet for small popouts to 7,400 feet (extremely large debris avalanche/torrent combination originating at the head of a major tributary of Mehl Creek). The next longest runout distances were two other debris avalanche/torrents in Gallagher Canyon and the head of Waggoner Creek. Their runout distances were about 5,500 feet. Most Torrent runout distances were in the 1,000 to 2,000 ft. range. A simple model for predicting runout distances of torrents(flows) in mountain channels in the Coast Ranges and Cascades was developed (Benda and Cundy, 1989). Their model basically predicts that flows have the potential to originate in channels with gradients of at least 36 percent and that a flow once started would continue until a tributary junction angle of 70 degrees or greater is reached or until a stream gradient of 6 percent or less is reached. For a future iteration, high risk channels could be mapped using this model. A note of caution: The farthest reaches of the biggest torrents could be in fact due to a phenomenon called dam break flow for which the model does not predict runout lengths.

4. Management Relationship

Refer to the Charts 6-4 and 6-5 for this discussion and the limitations discussion in the appendix. Through 1978 road-related landslides constituted over 50 percent of the management-related landslides mapped. This probably corresponds to the high road construction which went on in the fifties and sixties and the high precipitation years of the seventies. Percentages decreased after that reaching zero percent mapped in the 6/89 to 7/94 period. This drop corresponds to decreasing road construction decreased, better road construction practices, and from 1984 to 1994, near normal precipitation and prolonged drought.

About 58 percent of all the management-related slides mapped which were medium-sized and larger were road_related. About 73 percent of the management-related landslides mapped which were large to extremely large were road-related.

Only twelve Forest-related landslides were identified. One was the extremely large debris Avalanche/torrent at the head of a Mehl Creek tributary (mentioned under runout distances).

Harvest-related landslides on BLM land: From 1959 to 1994 10,290 acres of BLM land were clearcut harvested for the entire WAU. 123 harvest-related landslides were mapped during that period where we had aerial photo coverage (western part of the Mehl Ck. division missing).

Harvest-Related Landslides on BLM Land 1959 to 1994

Table 6-8

Size	Number	Percent	Percent(small excluded)
Small	73	59.3	
Medium	41	33.3	82.0
Large	8	6.5	16.0
Very Large	0	0	0
Extremely Large	1	0.8	2.0
All Sizes	123	100.0	100.0

Extrapolating to compensate for the missing coverage and then calculating for the number of slides per 1000 acres gives the following results:

Number/1000 acres

medium slides....4.50

Large slides....0.89

Very Large-Extremely Large slides....0.11

This translate to about one medium or larger harvest-related landslide originating on BLM surface per every 182 acres of BLM harvested land.

5. Highest Order of Streams Reached by Landslides

Refer to the Table 6-9 and the Chart 6-6 for the discussion on this topic.

Landslide Size Category

Table 6-9

Highest Order of Stream Reached	Percentage of a Landslide Size Category					Percent of all slides
	small	medium	large	very large	extmly large	
none	52.5	25.9	6.2	0.0	0.0	33.4
1st & 2nd	39.4	56.4	61.5	50.0	0.0	49.8
3rd to 7th	7.6	15.9	30.8	25.0	100.0	15.2
Umpqua	0.5	1.8	1.5	25.0	0.0	1.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

As expected the smaller the landslide size category the higher the percentage of landslides not reaching a stream. Small slides were twice as likely not to reach a stream as a medium slide and rose to eight times as likely not to a stream when compared to large slides. A high percentage of all slide reached 1st and 2nd order streams(about 50 percent). A relatively small percentage of small slides reached 3rd or higher order streams(7.6%), intermediary was the medium(15.9%), and highest were the larger slides(25 to 31%). All three of the extremely large slides reached third order streams or higher.

The percentage of landslides not reaching streams was pretty consistent from 1959 to 1989 (31 to 39 percent) and then raised significantly to 69 percent in the 6/89 to 7/94 period. During this period there were no large to extremely large slides mapped.

6. Landslide Risk Map

The soil slope map (Figure 6-1) makes a good landslide risk map for general planning purposes. Adjusting landslide numbers to what they would be if 0 to 30, 30 to 60, and 60 to 90 percent slope divisions were of equal area gives the following results:

Landslide Risks

Table 6-10

Soil Slope Map divisions	Dominant Slope (%)	Percent of Slides	Assigned Risk Rating
Green and Yellow	0 to 30	4.5	Low
Orange	30 to 60	24.6	Moderate
Red	60 to 90	70.9	High

These slope divisions on the map represent the dominant slope range. Inclusions of other slopes are present in nearly all of the map delineations. A percentage of landslides that fall within the 0 to 30 and 30 to 60 percent divisions originated on steep-sloped inclusions. An example are the very steep scarps which occur at intervals on certain moderate slopes. Note that this map only accounts for one of the big risk factors, slope. There are other factors which would be needed to be taken into account to get finer resolution of risk such as topographic position. At the scale of this map, slope categories make a good landslide risk categories for general planning purposes.

C. Disturbance History

The disturbance history of the Elkton-Umpqua WAU on forest lands managed for wood products has a pattern similar to the other WAUs where watershed analysis has been completed. The history given in this report has been primarily ascertained through interpretation of the aerial photographs and recent field experience and reports to cover 1994 to present.

The 1950s and 1960s were periods of high levels of road construction and logging. Many Arterial roads were typically located along and just above the major creeks. Spurs were often built into the bottom of side drainages where downhill logging would occur as far upslope as the reach would allow. Many midslope and ridgetop haul roads were also built for cable and tractor operations. Many were unsurfaced, on steep grades, and lacked adequate drainage. Sidecasting of cut material on steep slopes, a common practice, often fell directly into intermittent or permanent streams or later failed. Machinery operating in drainage bottoms was also common.

A very high percentage of logged land on slopes up to 40 percent was tractor yarded usually resulting in a high density of skid trails (loggers choice) ranging from bladed and heavily compacted to more lightly compacted and unbladed. A high percentage of land was directly impacted as tractors would often walk to nearly every stump. Some of these sites following harvesting were likely tractor piled for site preparation. Tractor piling could compact up to 80 percent of the ground as well as effectively remove most of the litter and some of the topsoil.

A fair amount of land was tractor yarded on slopes up to 70 percent. This usually resulted in a less dense pattern of skid trails but this necessitated a high percentage of them being bladed, many with cuts of 10 feet or more. In many cases, the trails went directly up the slope. Probably little attention was given to drainage. Spot field checks have shown bladed skid trails and the more primitive haul roads to be flat bladed and bermed on the side. Sedimentation off these roads and trails was probably high during, and for a time after their period of use.

Extensive groupings of tractor trails were apparently created during this period for salvage or high-grading type operations in old growth.

Surface erosion must have been a very significant short-term impact on water quality especially where activity occurred in riparian zones and steeper slopes. Long-term soil productivity losses due to compaction, mechanical removal and erosion of topsoil must also have been significant.

Landslides were also a significant source of sediment. Sidecast commonly traveled far down slope into drainages and often the overloading caused major debris avalanches that would sometimes develop into torrents as they entered channels. The Gallagher Canyon Debris avalanche/torrent in Sections 17 and 20, T24S, R6W is the largest of this type. Poor road drainage features and drainage being altered by happenings such as cutslope failures burying ditchlines were no doubt important contributors. Major harvest-related landslides also occurred but were not as common as the road-related slides. Major debris avalanches and torrents have occurred in unmanaged forests probably as a result of high intensity storms. About two thirds of all landslides mapped in the survey entered 1st degree or higher streams.

In the 1970s and early 1980s most of the major arterial roads were in place and the level of road construction declined. Locations were being confined more than in the past to upper slope and ridgetop positions. The practice of sidecasting on steep slopes declined entering the eighties. Even so landslide frequency remained relatively high. Four years in this period had rainfall 10 inches or more above average. This was probably a factor in the continued high incidence of landslides. The high intensity storms of the 1982-83 season probably accounted for the highest landslide numbers mapped in the inventory for any period. During this period a shift occurred from a greater incidence of 0.1 acre or larger landslides being road-related to being harvest-related.

From 1984 to 1994 landslides dramatically declined in numbers. Road related-slides constituted only 19 percent of all slides which were detected in the inventory. 72 percent were harvest-related. The average size grew considerably smaller on average. No very or extremely large landslides occurred during this period. Landslide numbers which yearly reached streams occurred at levels five to six times lower than that during the period of 1959 to 1983. Near average precipitation from 1984 to 1989 and drought in 1990, 91, 92 and 94, better road construction practices, continued trend to road ridgetop positions and an overall decline in road construction and harvesting were likely important factors in landslide decline.

Surface erosion and sedimentation appeared to be significantly down. Sediment choked riparian zones or raw stream banks were not distinguishable on the aerial photos. Field observations in Little Tom Folly, Magee and Waggoner Creeks watersheds in 1993 and 1994 found little of the stream bank surfaces stripped of vegetation, scoured or back-wasted due to seasonal high flows. Parts of Magee Creek on BLM land were negatively impacted by cattle grazing. A high percentage of the observed old roads and skid trails no longer received vehicle traffic, were in a state of healing and had minor erosion. There was still a fair number of unsurfaced roads that were erosion problems, especially those that remained unsurfaced on steeper grades, had deeper, finer textured soils and continued to receive some level of traffic (primarily in the Elkton Formation and the gentle to moderate slopes of the Bateman, Flournoy and Tyee Formations).

D. Present Condition (1995 to 1998)

1. Erosion and Mass Wasting

Increases in road construction and harvesting of second growth stands on private, and a series of exceptionally wet years with high intensity storms has seen a rather dramatic increase in landslide activity. The exceptional high intensity November 1996 storm was followed by intense precipitation in December 1996 and January 1997. The November storm produced record 24 hour precipitation totals but it was not a rain on snow event and soils prior to the storm were not saturated. The soils were in saturated conditions by the time of the latter storms. Road damage was quite high from landslides and plugged culverts on BLM roads. Erosion and mass wasting of BLM roads in the WAU, although substantial, were not near the magnitude of those of the 1950s through 1983.

The following are points made in "Storm Impacts and Landslides of 1996, Progress Report on Oregon Department of Forestry Studies" by the Oregon Dept. of Forestry, Oregon State University College of Forestry and the Oregon Forest Resources Institute; January, 1998. The study focused on the aftermath of the November 1996 storm that affected the Elkton-Umpqua WAU area and the February 1966 storm which affected the Lane County northward.

a. Review of past landslide studies: Swanson in 1977 found in the Mapleton Ranger District an increase in the landslide erosion rate by a factor of 1.9 going from unmanaged forest to clearcuts in most landtypes. The factor increased to 4.0 in the most landslide prone type. A Ketcheson field study of a small watershed unaffected by roads found a 3.7 times

increase in clearcuts over undisturbed forest. In the Oregon Coast Range (H.J. Andrews Experimental Forest), Dryness(1967) found that 72 percent of landslides greater than 100 cubic yards which occurred during the 1964-65 wet season were road related (12 fill failure, 5 cutbank failures, 6 cutbank and fill failures, 3 washed out culvert failures).

b. Landslide frequency varied over eight study sites from 36.9 landslides per 1000 acres at the Elk Creek site to only 0.6 landslides per 1000 acres at the Estacada site. (Note: 36.9 landslides per 1000 acres is a much greater frequency than mapped in the Elkton-Umpqua landslide inventory for high risk sites. The difference might be attributed to forest landslides and small landslides being highly undercounted due to the limitations of aerial photo interpretations. The Elkton-Umpqua inventory in the opinion of the Swiftwater Soil Scientist gives a pretty good picture of management related slides 0.1 acre and greater in size., especially in determining trends.)

c. Landslides occurred at much higher frequencies in the lands determined prior to the study to be high impact ("red zone") areas.

d. Stands were broken into four age classes: 0 to 9 years, 10 to 30 years, 30 to 100 years and greater than 100 years(mature). Landslide frequency in the 0 to 9 year class was greater than the mature forest class three out of four times, varying from 4.2 to 0.9 times the rate observed in mature forests. Landslide rates typically dropped in the 10 to 30 years class and remained low in the 31 to 100 year class and then may have increased in the mature class(greater spacing of trees probably a factor).

e. The landslide erosion rate in the 0 to 9 year class was typically doubled that of the mature forest.

f. Slope Steepness for all landslides including road-related measured from the top of the landslide scarp down (See the bar graph on landslide slope distribution Chart 6-7):

- 49 percent of landslides were on slopes 70 to 90 percent.

- Very few landslides(8 percent) were on slopes under 60 percent and there were no landslides that entered channels on slopes less than 40 percent.

- A substantial number of landslides (28 percent of total) occurred on slopes steeper than 90 percent.

g. Landform(what I was referring to as topographic position):

- Uniform(fairly straight without irregular surfaces): landslides most common in five out of eight sites.

- Landslides on concave was most common in the Scottsburg and Elk Creek sites (Tyee Formation).

- Convex sites were more common than expected.

- Landslides on irregular landforms(shape often result of past landslide history) were uncommon on all sites.

h. Road landslides made up only a small fraction of the total landslides that entered channels. However, individual road landslides can have very great channel effects. The road related landslides that did occur were smaller than those of the past.

i. About half of the road landslides occurring in the fill or below the road were related in some way to road drainage. The other half were mainly related to fill condition and slope steepness.

j. Landslides in harvested units were not associated with any apparent physical ground disturbance. Therefore, the effects of harvesting on the three sites with increased landslide frequency from these storms are likely related to either changes in water delivery to the soil or factors associated with roots.

k. 27 percent of the total of 136 stream miles surveyed had high impacts due to debris flows or dam-break floods. 4 to 74 percent of stream reach miles of high impact were influenced by road related slides. Considering the low number of road related landslides, one may conclude that roads have the potential to influence the channel network greater than their

proportionate numbers.

l. Torrent scour occurs in narrower steeper stream reaches. Deposition occurs in wider lower gradient reaches. li. streams greater than approximately 12 feet active width there were almost no torrent scour reaches. Likewise for stream reaches greater than 60 percent slope there are no depositional reaches.

m. Large woody debris characteristics in high impact stream reaches were extremely variable.

2. Soil Productivity and Hydrology of Ground-Based Impacted Ground

Cumulative impacts to soil productivity and flow routing of water resulting from past ground-based operations remain significant. The effects of compaction, soil removal and erosion due to the high density of old skid trails, log deck sites and abandoned roads will be long lasting. Compaction can take over 40 years to heal. Restoration of lost topsoil can take much longer. Certain areas have recovered quite well but overall moderate to heavy residual compaction, poor surface structure and poor organic matter content remains. On BLM impacted lands small gains in soil productivity over time can be anticipated with subsoiling and designated trail requirements as new projects on impacted tracts are initiated. I anticipate a large percentage of private land that had past ground-based activity would be entered again with ground-based operations so that soil productivity and flow routing cumulative impacts would remain significant indefinitely.

E. Summary Answers to Key Questions for Geology and Soils

What soil types are limiting vegetation?

Forest soil mapping units which are complexes of shallow and moderately deep soils and complexes of shallow, moderately deep and rock outcrop have the lower site indexes (Figure 6-7). These are the 233E, 237F, 437F and 437G soil mapping units comprising 24,600 acres of the WAU. About 80 percent of these mapping units are on slopes greater than 60 percent. The main soils are the Umpcoos, Digger and Bohannon in the Udic zone and the Larminie and Atring soils in the moist Xeric zone. The 50 year King site index on the shallow end is 61 to 82 and 98 to 118 on the moderately deep end.

Also in forested areas are very shallow soils (less than 10 inches to hard, non fractured bedrock) which form open patches which can only support grass, forbs and in some cases shrubs. Rock outcrop is usually present as small inclusions or as a major component. Mapping unit 136E and 136F represent this type where rock outcrop is a major component. The soil series is Dickerson. Only 25 acres of this type was mapped but aerial photo interpretation suggests considerably more than this.

The moisture of well drained soils is available for the longest periods in the udic zone (generally in the highest elevations and on lower north slopes), followed by the moist xeric zone and then the dry xeric zone.

Hydrophytic vegetation is found in abundance on poorly and somewhat poorly drained soils as shown in Figure 6-8. These sites could qualify as wetlands and are concentrated in the floodplains and terraces along the Umpqua River and Elk Creek. Other large concentrations are along a segment of Heddin Creek (Sec. 34, T22S, R8W and Sec. 3, T23S, R8W), Little Canyon Creek and tributary (Sec. 19, 29 and 30, T24S. Soil mapping units which have poorly drained soils are 40A (riverwash), 66A (Waldo series), 81A (Conser series) and 148D (Panther series. Soil mapping units which have somewhat poorly drained soils are 115D (Pengra series), 141E, 68C and 68D (Dupee series), 501A and 501C (Banning Series), 70A (Coburg series), 71A (Sibold series), 72A (Redbell series) and 99C (Stockel series).

What is the most significant sediment input to this watershed?

The most significant source of sediments of recent years when yearly precipitation has been near normal and intense storm events missing has been erosion of road surfaces, cuts and ditchlines. The biggest sediment producers per given length of road are unsurfaced roads which receive traffic and which are on steep grades and in deep soils formed in siltstone. Long winter haul routes on worn rock and in riparian zones could have the biggest inputs of sediments. Overall, roads built in the Elkton Formation have the largest erosion and sedimentation problems.

Coos Bay District in their Upper Middle Umpqua watershed analysis report included information (Table 6-11) which gives a hypothetical road situation and demonstrates how surface erosion levels can be reduced given different treatments. The hypothetical situation is a mid-slope road segment that intersects a stream and is in-sloped. The cutslope supports 50 percent vegetation cover, the fill slope supports 100 percent vegetation cover and the road has a four to six inch deep rocky surface. No mention was made of soil depth but it is presumed to be as deep as the roadcut.

Tons of Sediment/Acre of Road/Year Predicted for Different Management Scenarios

Table 6-11

	administrative use only		1 to 4 log trucks/day		greater than 4 log trucks per day	
	tons/ac of road/year	hazard rating	tons/ac of road/year	hazard rating	tons/ac of road/year	hazard rating
As described	11	Low	27.8	Low	216.8	High
Increase cut slope vegetation to 80%+ only	9	Low	25.8	Low	214.8	High
Change to an out slope road, no other changes	9.9	Low	25	Low	195.1	High
Increase rock depth to greater than 6 inches only	8.9	Low	23.6	Low	127.6	Medium
Increase rock depth to > 6 inches; outslope; increase vegetation on cut to > 80 %	6.9	Low	15.3	Low	109.8	Medium
Increase cutslope vegetation to 80%+ and pave the road surface	5.1	Low	6.4	Low	20.8	Low

Landslides might have been the biggest sediment inputters to streams in the recent years when precipitation has been well above normal and intense storms have occurred. Road related landslides have been relatively few in comparison to the total number of landslides but their impacts to stream channels have been disproportionately large. While large landslides are relatively few in forests in near normal precipitation years, they can be quite common in years with intense storm events. Debris torrents are capable of traveling great distances down channels. The longest runout distance discovered in the landslide inventory spanning 1953 to 1994 was 7400 feet. Runout distances of 1000 to 2000 feet were quite common.

What are the trends in sediment input?

Very high sediment inputs from surface erosion and mass wasting occurred from the fifties through the early eighties due to a combination of management practices, especially those associated with roads and skid trails and high intensity precipitation events. Sidecasting on steep slopes and road and trail construction and use in and near stream bottoms were big factors. Natural landslides were big contributors when there were intense storm events. Near normal precipitation and then drought dominated the mid eighties to 1994. A big decline in landslides, and sedimentation during this period was probably due to the combinations of weather, a decline in road construction and harvesting, better road construction practices and locations. With the onset of above normal precipitation, high intensity storms, increased road construction and the widespread harvesting of second growth on private, sedimentation levels have risen again. These new levels, although important, are probably well under those of the fifties and sixties. The size of road related landslides, for example, are overall smaller.

About one third of landslides did not reach streams from 1959 to 1989. During the low activity drought years of 1989 to 94 over two thirds of the landslides failed to reach streams. Also during the 1989 to 1994 period overall smaller and fewer landslides occurred than in the past. It is probably safe to speculate that there has been a substantial rise in the number of landslides reaching streams during the recent wet years. Future BLM roads and spurs are not expected to pose

much of a landslide risk because of best management practices and careful consideration given to their locations. The trend has been not to build on high risk sites. A percentage of old BLM roads would likely continue to be at risk of landslides which can deliver substantial volumes of sediment to the streams.

It is the opinion of the Soil Scientist that many (maybe most) of the big landslide potentials any road posed have been realized through its history, especially when considering the number of years since 1953 with well above average precipitation and intense storm events. Road related landslide volumes caused by the recent intense storms, although significant, have not matched the highs recorded in the fifties to early eighties (indicated by the ODF 1998 report "Storm Impacts and Landslides of 1996"). Future potentials would likely be created on these old roads through drainage disruptions (blocked culverts or small cutslope failures burying ditchlines, as examples) which direct road runoff or captured streams onto surfaces which were stable under the old drainage network. Drainage redirection onto slopes oversteepened with sidecast would be at high risk.

Past Pacific Northwest studies found landslide numbers in clearcuts to be up to four times as frequent as in unmanaged forest. Harvest related landslides of 0.1 acres in size or larger that originated on BLM surface in the WAU and identified in the landslide inventory occurred at a frequency of about one per 182 acres of BLM harvested land. Those landslides 0.5 acres or larger occurred at a frequency of about one per 1000 acres of BLM harvested land. In the future landslides in BLM harvest units will likely be fewer in number, overall smaller and not be as likely to reach streams for given storm intensities as was in the past because of best management practices and riparian reserve requirements. Riparian reserves often cover the sites most vulnerable to landslides (headwalls, swales and hallows). Landslides can be expected to occur in the riparian reserves over time but overall at a frequency considerably less than that of traditional clearcuts. Some would be debris torrents which deliver large woody debris and coarse rock material. Most of the larger failures in riparian reserves would likely occur during the highest intensity storm events.

What significant geologic events are affecting stream channels?

Debris torrents and debris dam breaks which scour deeply in the steep headwaters and deposit large amounts of earth, rock and woody debris on gentle grades below. These events probably have severe short term impacts and large long term benefits for fish. High stream flows have scoured banks removing vegetation and deposited sediments elsewhere.

Where are landslides expected to be more frequent in relation to management activities?

Slope is one of the biggest factors affecting landslides. Few landslides occur on slopes less than 60 percent. The soil slope class map (Figure 6-1) works well for general landslide risk categorization. See the discussion on page 6-9 for the explanation. The Oregon Department of Forestry designates harvest sites as being "high risk" for regulatory purposes where:

- headwalls or draws are steeper than 70 percent.
- abrupt slope breaks where the lower slope is steeper and exceeds 70 percent, except where the steeper slope exceeds 70 percent.
- inner gorges with slopes steeper than 60 percent.
- other slopes steeper than 80 percent, except for stable rock.

These ODF "high risk sites" slope criteria probably can serve as a tool used in conjunction with the soil slope class mass map for giving finer resolution to landslide risk for general planning purposes.

Shallow translational landslides are expected to be most frequent on the very to extremely steep slopes, especially those in concavities (headwalls, swales and hallows) in highly dissected terrain and at abrupt slope breaks where very steep to extremely steep scarps are immediately below, especially if the slopes are aligned in about the same direction of the dip of the rock strata. In certain cases drainage might have daylighted from dipping rock strata and contributed to landslide occurrence. The Bateman, followed by the Flourney and Tyee Formations are the most susceptible to shallow translational slides.

The Elkton Formation and the slopes of the Bateman, Flourney and Tyee Formations aligned with the dip are most susceptible to widely spaced deep-seated slump and earth flows. Those slopes of the Bateman, Flourney and Tyee formations that are aligned with the dip are usually gentle to moderate (20 to 60 percent) and sometimes broken by very steep scarp inclusions. A combination of scarps, hummocky ground, sag features and young disrupted drainages are signs of slump earth-flow movements. Small individual features could be a part of a massive ancient slump-earth flow features. None has yet been identified in the field.

Karl Broda, the Roseburg District geotechnical engineer, has agreed to develop safety factors and risk ratings at some point in the future for the predominant upland forest soils for various slopes, moisture regimes, tree root densities, tree root anchorings in bedrock and topographic position.

Soil depth and cohesion are important characteristics. Generally low cohesion soils with depths of about five feet or deeper would be at highest risk for a shallow translational failure on a given steep slope. Very deep, clayey soils on not so steep ground could be subject to rotational slumping if adequate moisture is present.

Any soil on a steep swale can fail and develop into a torrent given enough moisture moving through it. Gradients as low as 36 percent may be enough for a torrent to be initiated and may travel great distances until a junction with another stream has an angle of 70 percent or greater or a stream gradient of six percent or less is reached.

F. Key Questions for Stream Channels

- Is there evidence of channel change from historic conditions?
- Where are the areas of stream bank instability as related to future potential thinnings?
- Where are the stream channels that have the highest sensitivity to various inputs?
(eg. coarse & fine sediment, flow changes, CWD)

F. Geomorphology and Stream Channel Interaction

Channels differ in shape depending not only on the size of the stream but also on climatic-geologic characteristics. The width of a river such as the Umpqua increases downstream faster than depth. The width at bankfull stage is approximately 470 feet and a depth of only 22 feet at the Umpqua River @ Elkton, Oregon stream gage. David L. Rosgen has developed a river classification system for describing rivers and streams. The classification is based on parameters of form and pattern determined at the bankfull stage. The system is limited in that it doesn't describe a whole drainage system, but is a very useful approach to stream restoration.

The Umpqua River near Elkton has been classified as a C channel from a level 1 analysis. A level two assessment in the field is necessary to determine entrenchment ratio, width/depth ratio, sinuosity, channel slope, and channel materials in order to validate level 1 conclusions.

Rivers increase in size downstream as tributaries increase the contributing drainage area and subsequent discharge. The channel's width and depth increases, general bed-particle size decreases, and the gradient flattens out as one moves downstream. Furthermore, the longitudinal profile of streams in the WAU are concave in shape (Charts 5-6, 5-7, 5-8). From these profiles, streams may be divided into sediment source areas, transport areas, or depositional areas based upon the gradient of the channel. High gradient streams located in the upper reaches of watersheds are source areas for debris torrents or debris flows. Heddin, Brads, Mehl, Little Canyon, Martin, Williams, Waggoner, and Yellow creeks have very high gradient reaches at the headwaters. Erosion and sedimentation from source areas are natural processes in mountainous terrain. When landslides occur at a natural rate, they provide an important supply of gravel and large trees from these areas, necessary to create stepped channel morphology and habitat (Naiman 1993). Medium gradient streams are transport areas that are relatively stable, and can transport gravels and large wood to downstream fish bearing reaches. Medium gradient stream reaches may contain large wood; however, over a long time period, wood is moved downstream by flows of large magnitude. Low gradient streams (Rosgen C channels) are likely to change over time as channels move and adjust from the wide range of flows that occur through time. Low gradient streams provide the most fish habitat because they have meanders, under cut banks, deep pools, gravels accumulated on the floodplain, and coarse woody debris. Yellow creek, Waggoner creek, Brads creek, Heddin creek, Lost creek, Little Canyon creek, and Mehl creek have at least three miles of low gradient stream lengths. Yellow creek and Mehl creek have the most fish habitat based on stream gradient, and may be considered for restoration based on preliminary analysis.

There exists a relationship between channel length in miles to drainage area (Leopold et al., 1992). The relationship for the WAU can be described by the equation:

$$L = 1.4A_d^{0.6}$$

where L is channel length in miles and A_d the drainage area in square miles. The average value of the coefficient for the WAU is 1.4, but may range between 0.9 and 2.1 depending on location. The exponent generally lies between 0.6 and 0.7 depending on the geographic region of the United States. In summary, as we move downstream and consider larger basin areas, drainage basins elongate, whereby channel length increases faster than channel width. The above equation implies that 1 square mile of drainage area is sufficient to produce and maintain 1.4 miles of perennial flow.

The Tyee Formation shows prominent strike/dip features that are relatively predictable across the landscape. Streams cut through contact zones or between areas aligned with and against the geologic dip. Maps also show ridges and streams that are aligned mostly parallel to one another. Streambanks on one side of a channel may be aligned against the dip, and exhibit steep slopes and higher drainage densities. The other streambank is aligned with the dip have gentler slopes and lower drainage densities. The Elkton Formation occurs mostly to the west of the Umpqua River and characterized by thick beddings of siltstone with minor layers of sandstone. Siltstone is more readily weathered, which may explain the longer lower gradient stream reaches west of the Umpqua River. The assumption is made that streams naturally down-cut to a baseline level quicker than the Tyee Formation (east of the Umpqua River), and may account for the longer lower gradient stream reaches. These low gradient reaches tend to store sediment and gravels along associated floodplains.

Area (Table 5-2) is an important geomorphic feature and can used to determine flood potential (Table 5-3) and total annual yield. As was stated earlier, only one of the subwatersheds (Yellow Creek) function as a catchment, and by definition, the area bounded by watershed divides from which water drains or flows downhill to or past the point in question. The other delineated drainages are frontal to the Umpqua River and contain land area from more than one catchment. These characteristics are alluded to in the Streamflow section, in which flood potential was calculated for frontal areas.

Drainage density is the sum total length of streams divided by the drainage area (Leopold et al.). Generally, drainage densities may be useful in determining streamflow responses and erosion potential. A more dissected catchment, such as Bear-Doe, will respond to rainfall much quicker and with greater magnitude than McGee creek. The lowest drainage density values are considered to be between 3.0 and 4.0 mi/mi² in the Appalachian Plateau Province. Values in the badlands of New Jersey have been measured as high as 1100 to 1300 mi/mi². Drainage densities for the WAU range from 2.6 to 6.5 mi/mi², but may have varying accuracies because not all streams have been mapped in GIS. The total stream miles for the WAU are located on Table 5-2, while main stem stream lengths by creek are in Charts 5-6, 5-7, and 5-8.

Figure 6-1

Elkton Umpqua Watershed Soil Slope Map

T21S

T22S

T23S

T24S

T25S

MEHL
CREEK

MC GEE
CREEK

ELKTON

YELLOW
CREEK

LOST
CANYON

R7W

R6W

Scale 1:180000

0 1 2 3 4 Miles



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-  Slope - 0 to 9%
-  Slope - 3 to 30%
-  Slope - 30 to 60%
-  Slope - 60 to 90%
-  Water



LEGEND FOR SOIL SLOPE MAP

Nearly Level (*green*): 0 to 3 percent slopes with small inclusions of other slopes

Gentle (*yellow*): 3 to 30 percent slopes with small inclusions of other slopes which may include scarps with very to extremely steep slopes.

Moderate (*orange*): 30 to 60 percent slopes with small inclusions of other slopes which may include scarps with very to extremely steep slopes.

Steep to Very Steep (*red*): 60 to 90 percent with small inclusions of other slopes. Extremely steep may be locally common.

steep = 60 to 75 percent slopes

very steep = 75 to 90 percent slopes

extremely steep = greater than 90 percent slopes.

Extremely steep slopes up to 130 percent may have soil profiles. Rock outcrop most often is in the form of vertical or near vertical ledges.

Water (*blue*)

Table 6-1

SOIL SLOPE CATEGORIES

SLOPE CLASS	ACRES	PERCENT of AREA
0 to 3 percent	4,803	5.3
3 to 30 percent	32,168	35.3
30 to 60 percent	28,132	30.9
60 to 90 percent	24,080	26.4
Water	1,897	2.1
TOTAL	91,080	100.0

Legend for Geologic Map Figure 6-2



Teb = Bates Formation



Tec = Elkton Formation



Tet₃ = Sumner member of the Elkton



Tet₂ = Type II member of the Elkton



Tet₁ = Type III member of the Elkton



Tet₀ = Unconformity



Ter₁ = Upper part of the Elkton



Cal = Calverton Formation



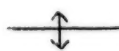
Qls = Quaternary Deposits



angle of dip in degrees

strike-slip fault

normal fault (South of Harrisburg)



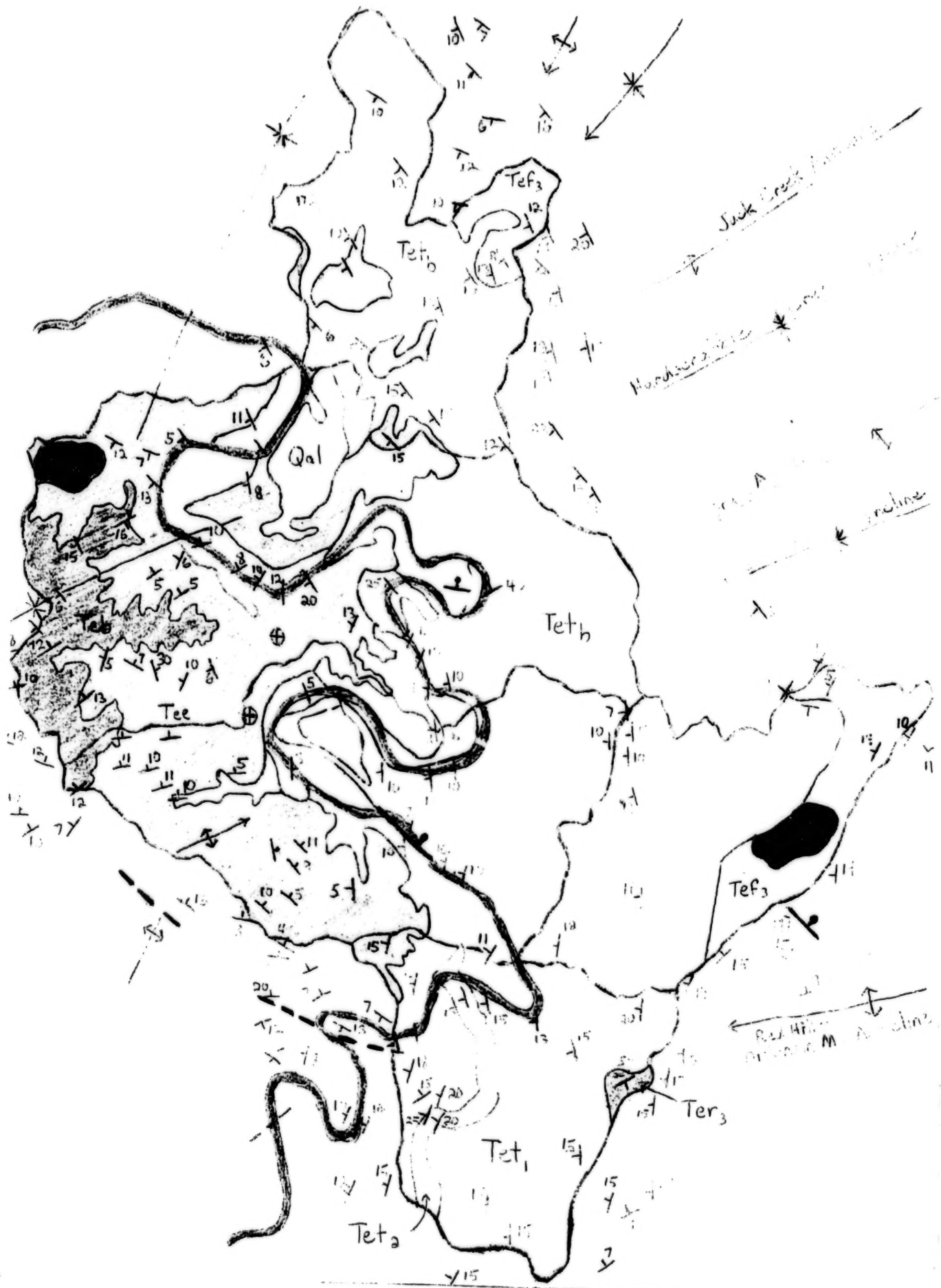
axis of anticline



axis of syncline



fault, dashed where inferred
half and basin downthrown block



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Topographic Relationships Commonly Occurring in the Luremun, Flournoy and Tye Formations

Sloping from major ridgeline & closely oriented in the same direction of the dip of the rock strata

Generally gentle to moderate slopes (12 to 60%) (inclusions of steep to extremely steep scarps and gorges of some larger streams), shallowly incised with side drainages and subject to widely scattered slump earthflow activity and at the scarps and gorges, shallow translational slides.

Soils overall deeper, less gravelly and more clayey

Common Soils

Windygap & Honeygrove - deep to very deep, clayey

Bellpine & Peavine - moderately deep, clayey

Bateman, Preacher & Fernhaven - deep to very deep, loamy

Digger & Atring - moderately deep, very gravelly, loamy

Bohannon - moderately deep, gravelly, loamy

Sloping from major ridgeline & closely oriented in the opposite direction of the dip of the rock strata

Generally steep to very steep (60 to 90%), deeply dissected with side drainages, and subject to shallow shallow translational slides and torrents.

Soils overall shallower, more gravelly & less clayey

Common Soils

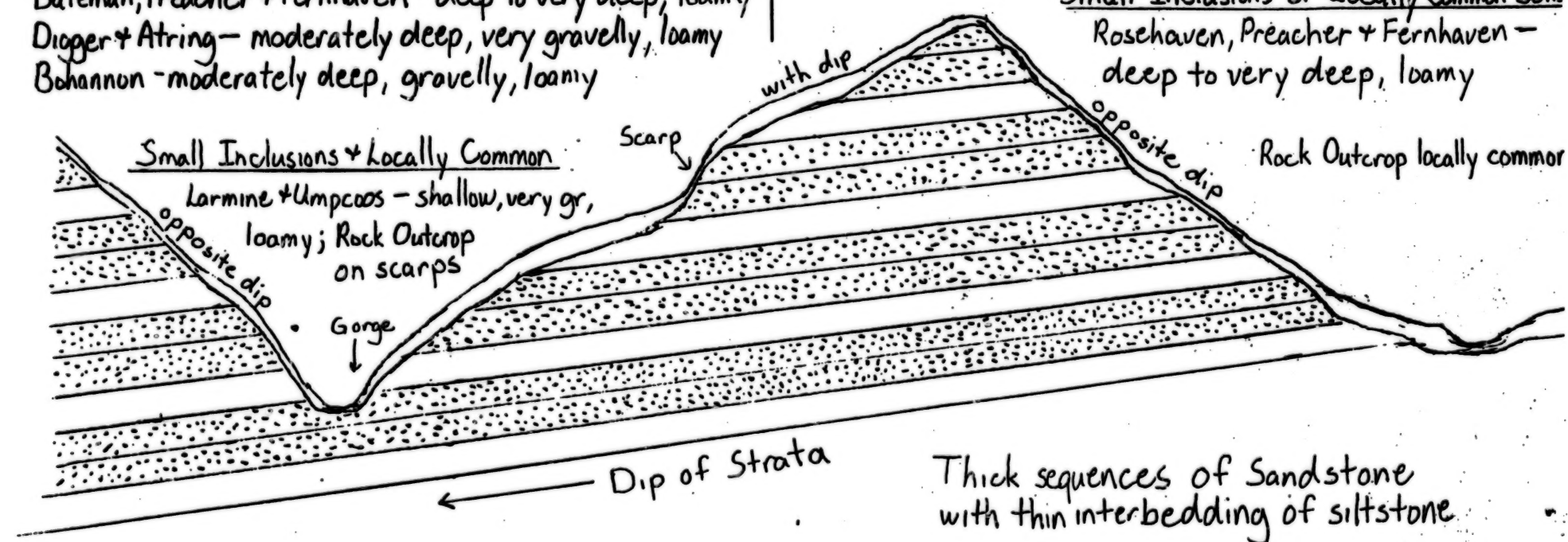
Larmine & Umpcoos - shallow, very gravelly, loamy

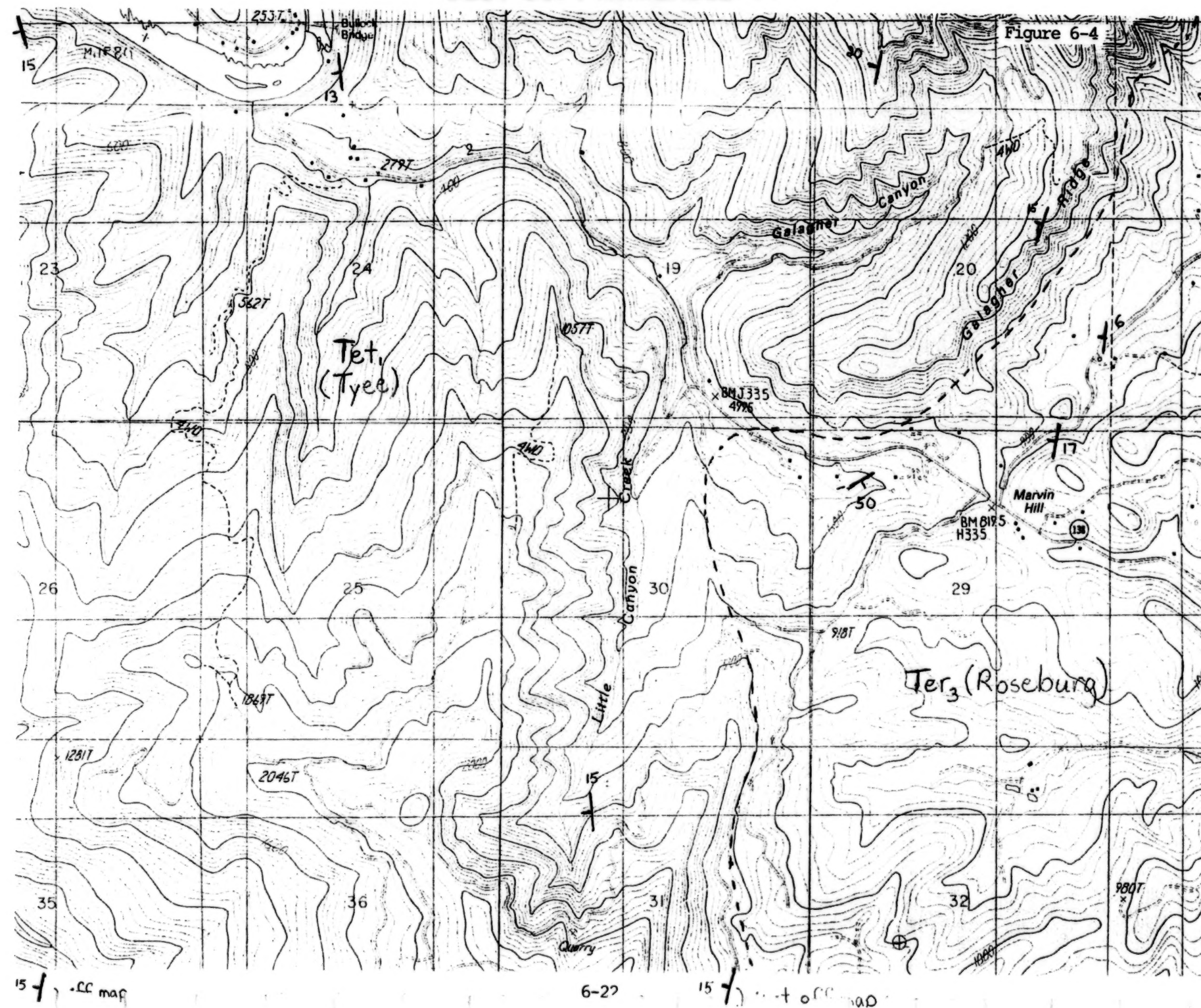
Atring & Digger - moderately deep, very gravelly, loamy

Bohannon - moderately deep, gravelly, loamy

Small Inclusions or Locally Common Soil:

Rosehaven, Preacher & Fernhaven - deep to very deep, loamy





Topographic Relationship Commonly Occurring in the Elkton Formation. The Elkton Formation is characterized by Thick Sequences of siltstone with minor interbedding of Sandstone

Generally gentle to moderate slopes (12 to 60%) most commonly incised with shallow side drainages, but also incised deeply by the larger streams which may have steep to extremely steep inner gorges. Small areas of steep to extremely steep scarps may break up the gentle and moderate slopes at intervals. There also may be small areas of remnant sandstone caps which resemble the Bateman, Flourhoy and Tye Formations. The Elkton Formation topography may be subjected to widely scattered slump-earthflow activity and at the scarps, gorges and sandstone caps, shallow translational slides.

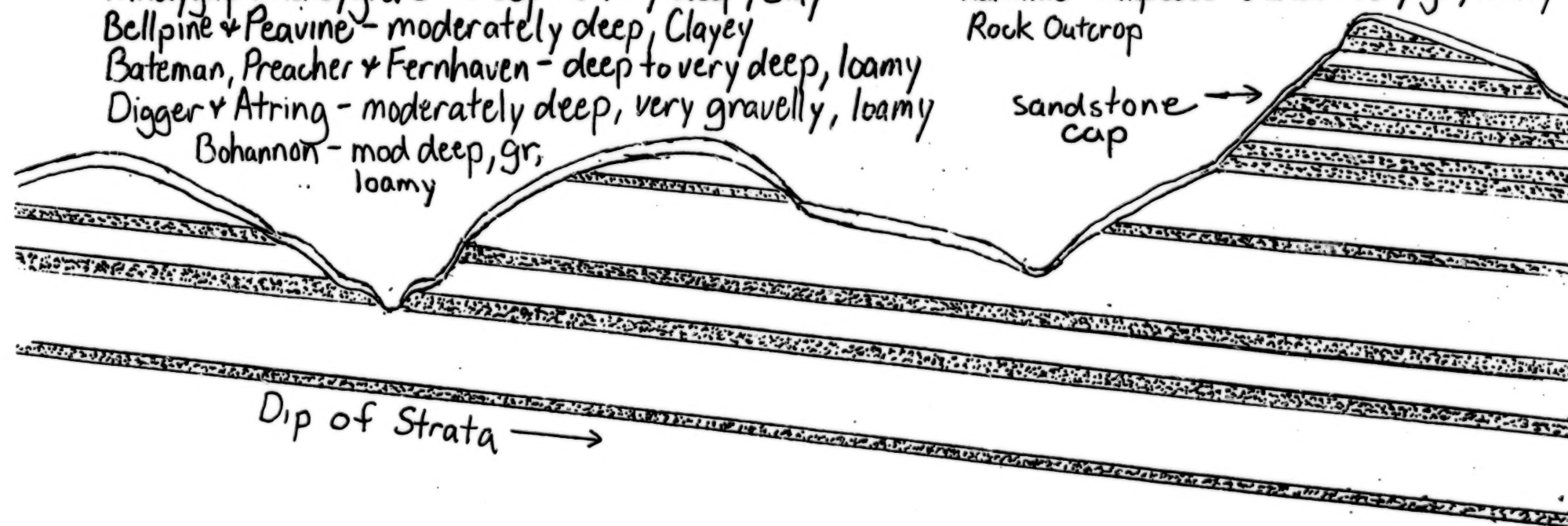
Soils overall are deeper, less gravelly and more clayey.

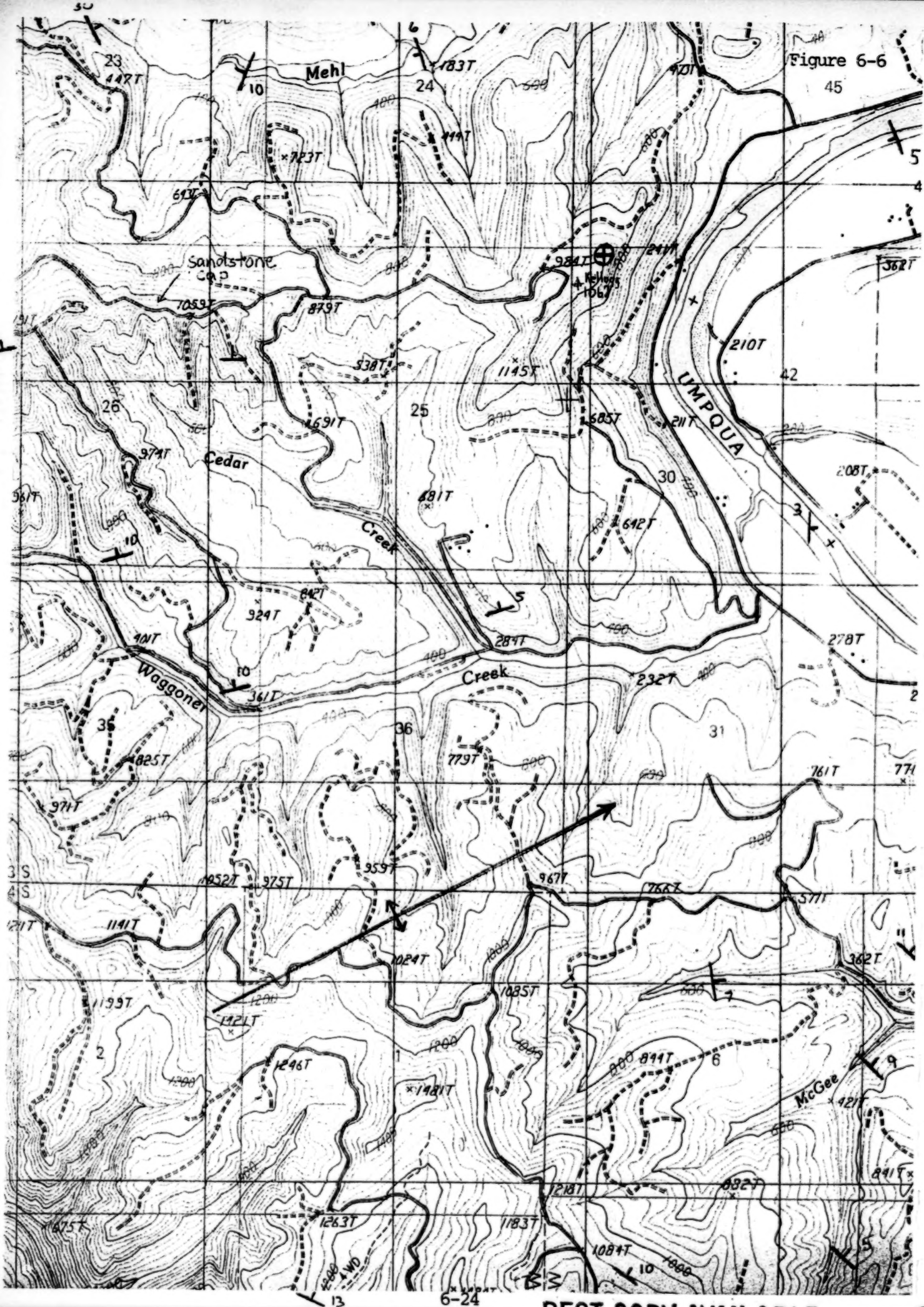
Common Soils

Windygap & Honeygrove - deep to very deep, clay
Bellpine & Peavine - moderately deep, clayey
Bateman, Preacher & Fernhaven - deep to very deep, loamy
Digger & Atring - moderately deep, very gravelly, loamy
Bohannon - mod deep, gr, loamy

Small Inclusions & Locally Common

Larmine & Umpcoos - shallow & very gr, loamy
Rock Outcrop





Legend for Soil Depth Map

Note: Average soil depths increase going down the legend, red having the shallowest average depths and green having the deepest average depths.

Red: Soil mapping units which contain rock outcrop as a major component and soil mapping units which only have shallow soils as a major component. Parts of these mapping units are unable to support trees.

Orange: Soil mapping units which are a complex of shallow and moderately deep soils as the major components.

Yellow: Contains the following soil mapping units:

those which only have moderately deep soils as a major component.

those which have only deep soils as a major component.

those which are a complex of the moderately deep and very deep soils as the major components.

Green: soil mapping units which only contain very deep soils as major components.

Definition of terms:

major component: A component which comprises 15 percent or more of the mapping unit area.

shallow: less than 20 inches to bedrock

moderately deep: 20 to 40 inches to bedrock

deep: 40 to 60 inches to bedrock

very deep: greater than 60 inches to bedrock

Figure 6-7

Elkton Umpqua Watershed

Soil Depth Map

T21S

T22S

MEHL
CREEK

ELKTON

T23S

YELLOW
CREEK

T24S

MCGEE
CREEK

LOST
CANYON

T25S

R7W

R6W

Scale 1:180000

0 1 2 3 4 Miles



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Rock Outcrop and Shallow Soils as a component
Shallow Soils Only - Moderately Deep Soils
Moderately Deep to Deep Soils
Very Deep Soils
Water

Legend for Soils Drainage Map

Poorly drained: Soil water is removed so slowly that the soil remains wet at shallow depths during the growing season. Water tables are commonly at or near the surface and are permanent or persistent.

Somewhat poorly drained: Soil water is removed so slowly that the soil is wet at shallow depths for significant periods during the growing season. Water tables commonly reach shallow to moderately deep depths and are transitory to permanent.

Moderately well drained: Soil water is removed from the soil somewhat slowly during some periods of the year. Internal free water occurrence commonly is moderately deep and transitory to permanent. The soils are only wet for a short time within rooting depths during the growing season.

Well drained: Water is removed from the soil readily but not rapidly. Internal free water occurrence is deep to very deep. Water is available to plants throughout most of the growing season. Wetness does not inhibit growth of roots for significant periods during most growing seasons.

Somewhat excessively drained: Water is removed from the soil rapidly. Internal free water occurrence commonly is rare or very deep. The soils are commonly coarse textured.

Excessively drained: Water is removed very rapidly. Internal free water occurrence commonly is rare or very deep. The soils are commonly coarse textured.

Figure 6-8

Elkton Umpqua Watershed Soil Drainage Map

T21S

T22S MEHL
CREEK

ELKTON

T23S

YELLOW
CREEK

MCGEE
CREEK

T24S

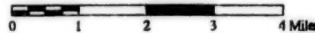
LOST
CANYON

T25S

R7W

R6W

Scale 1:180000



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- Poorly Drained Soils
- Somewhat Poorly Drained Soils
- Moderately Drained Soils
- Well Drained Soils
- Excessively and Somewhat Excessively Drained Sandy Soils
- Water

Weather Station at Drain, Oregon Latitude 4340N Longitude 12319W
at an elevation of 292 feet

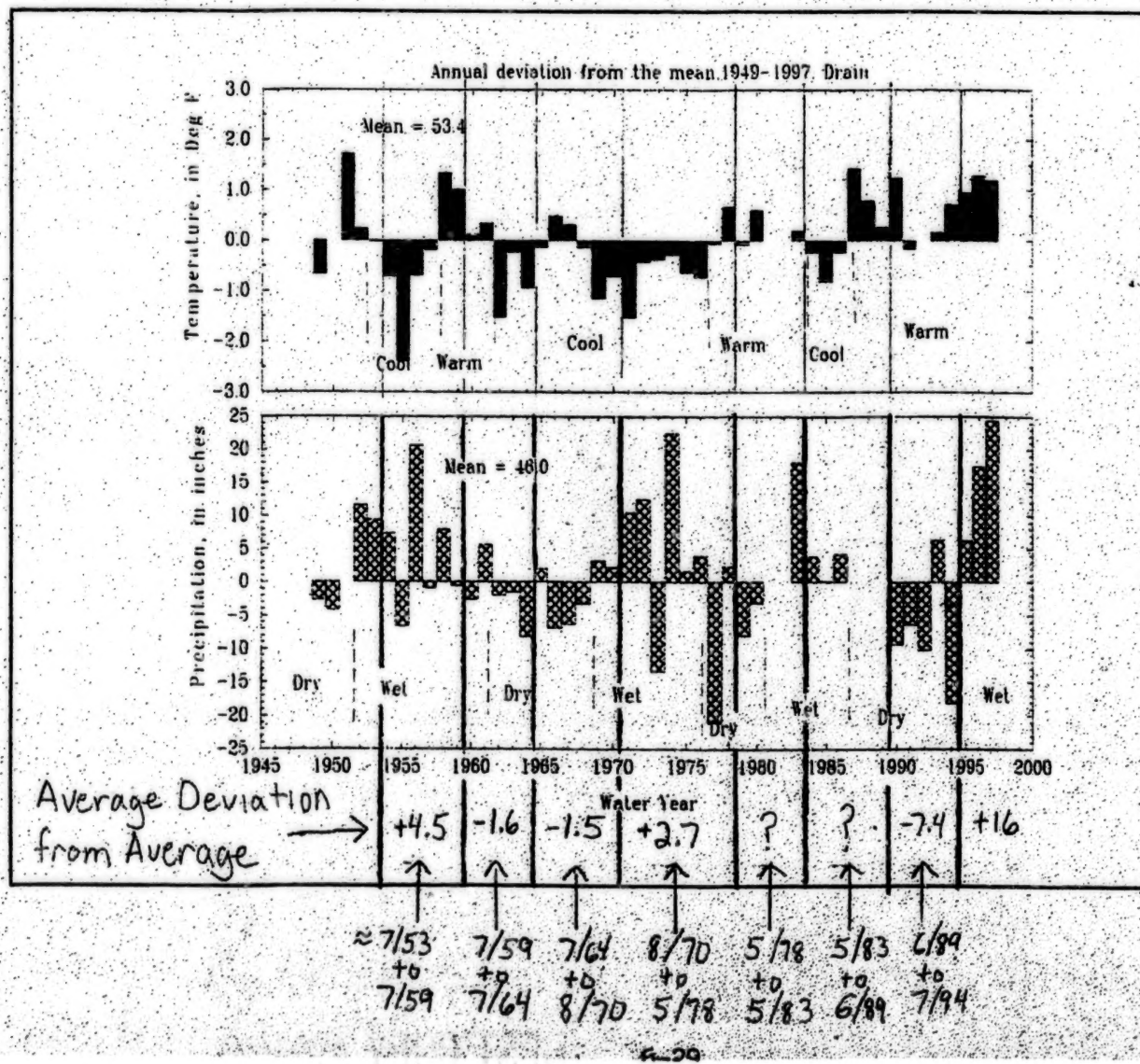
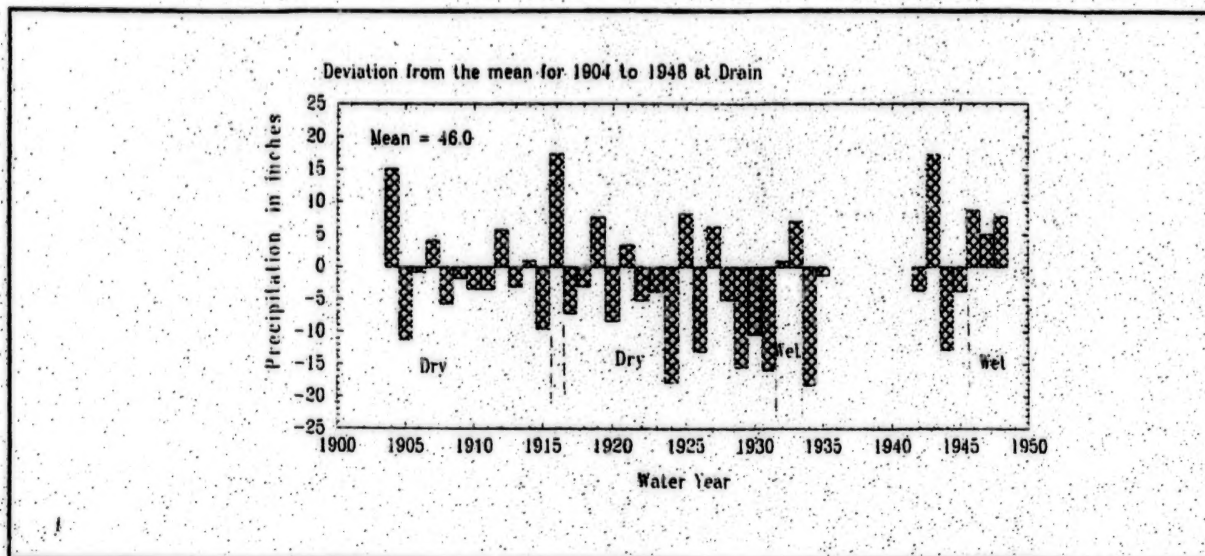


Chart 6-2

Average. No. of Landslides/year (Small excluded)

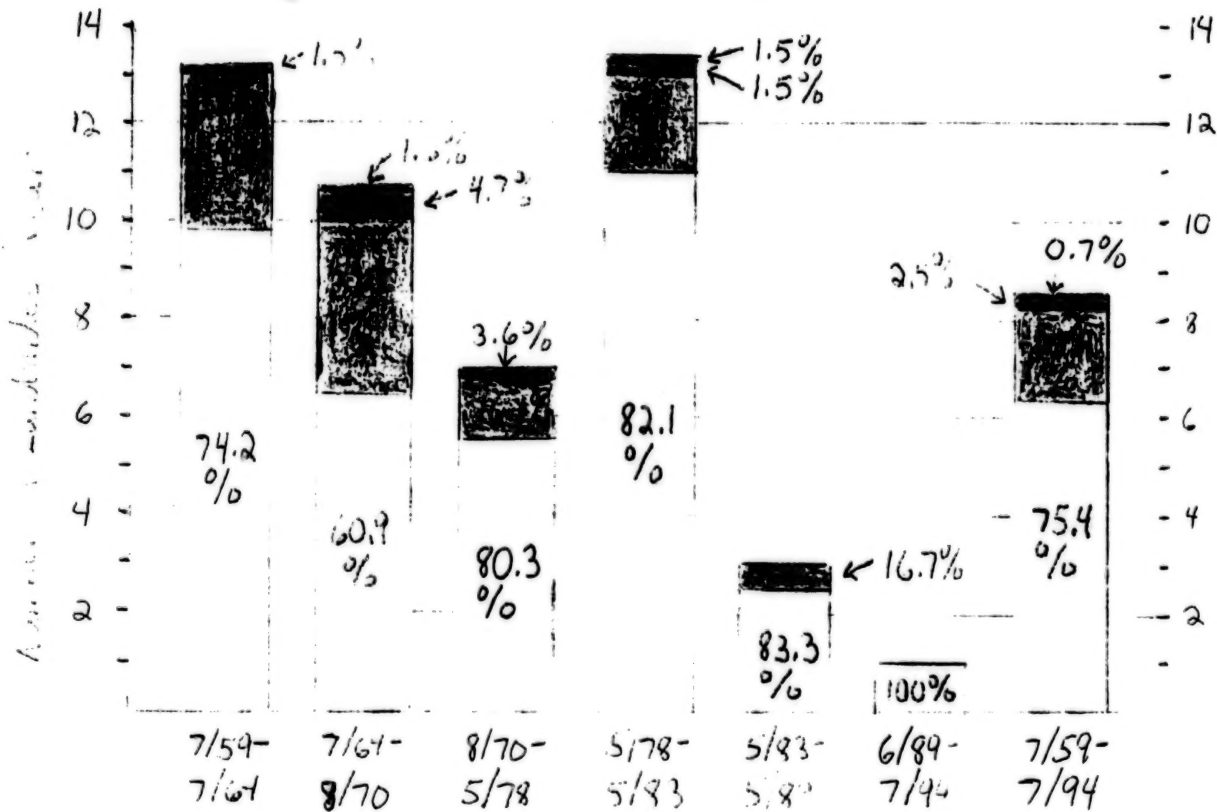
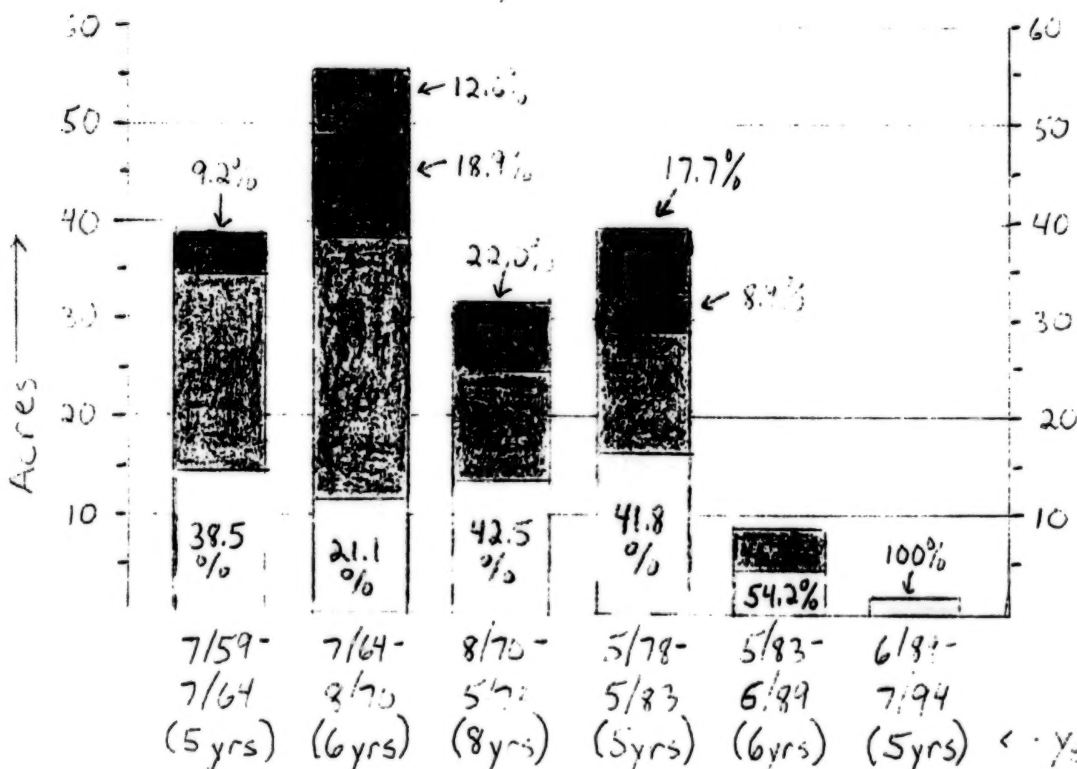


Chart 6-3

Approximate Acreage of Landslides (Small Excluded)



Landslide size: yellow = medium
 Orange = Large
 Red = Very Large
 Blue = Extremely Large

Chart 6-4

Average Number of Management Related Landslides / Year
(Yellow = Harvest Related Orange = Road Related)

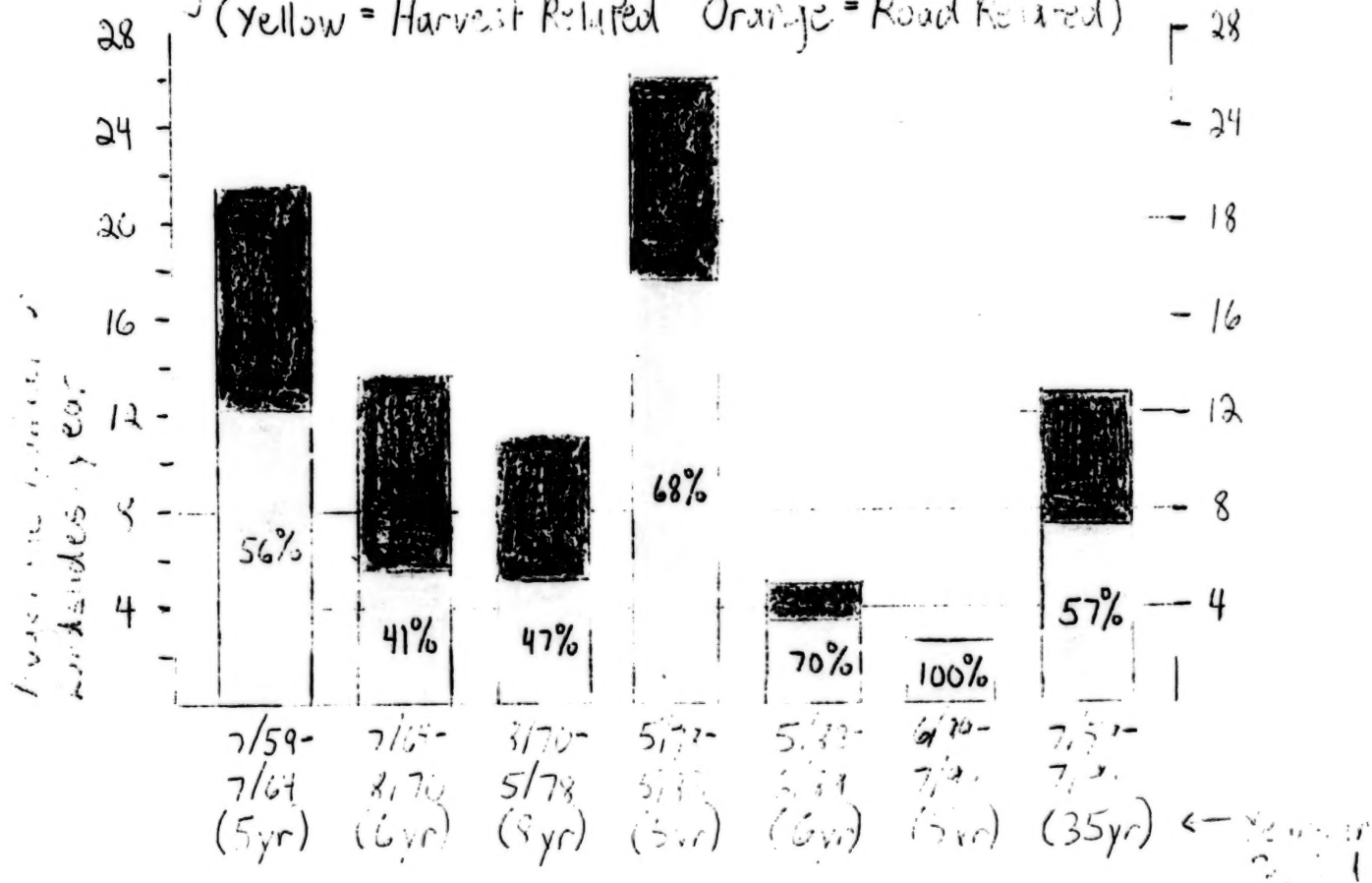
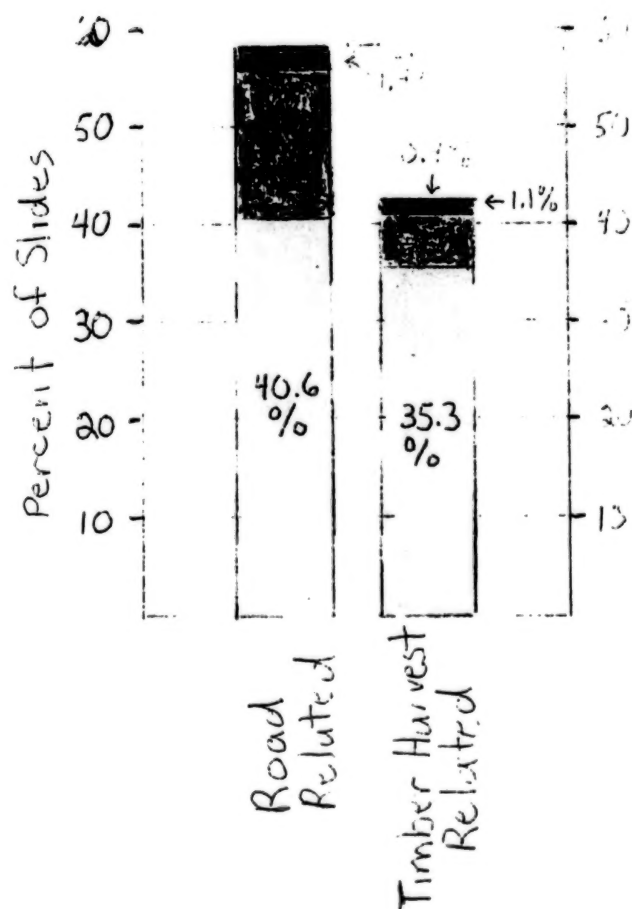


Chart 6-5



Percentage of Management Related Landslides
(Small size slides excluded)
For 35 Year Period (7/54 to 7/74)

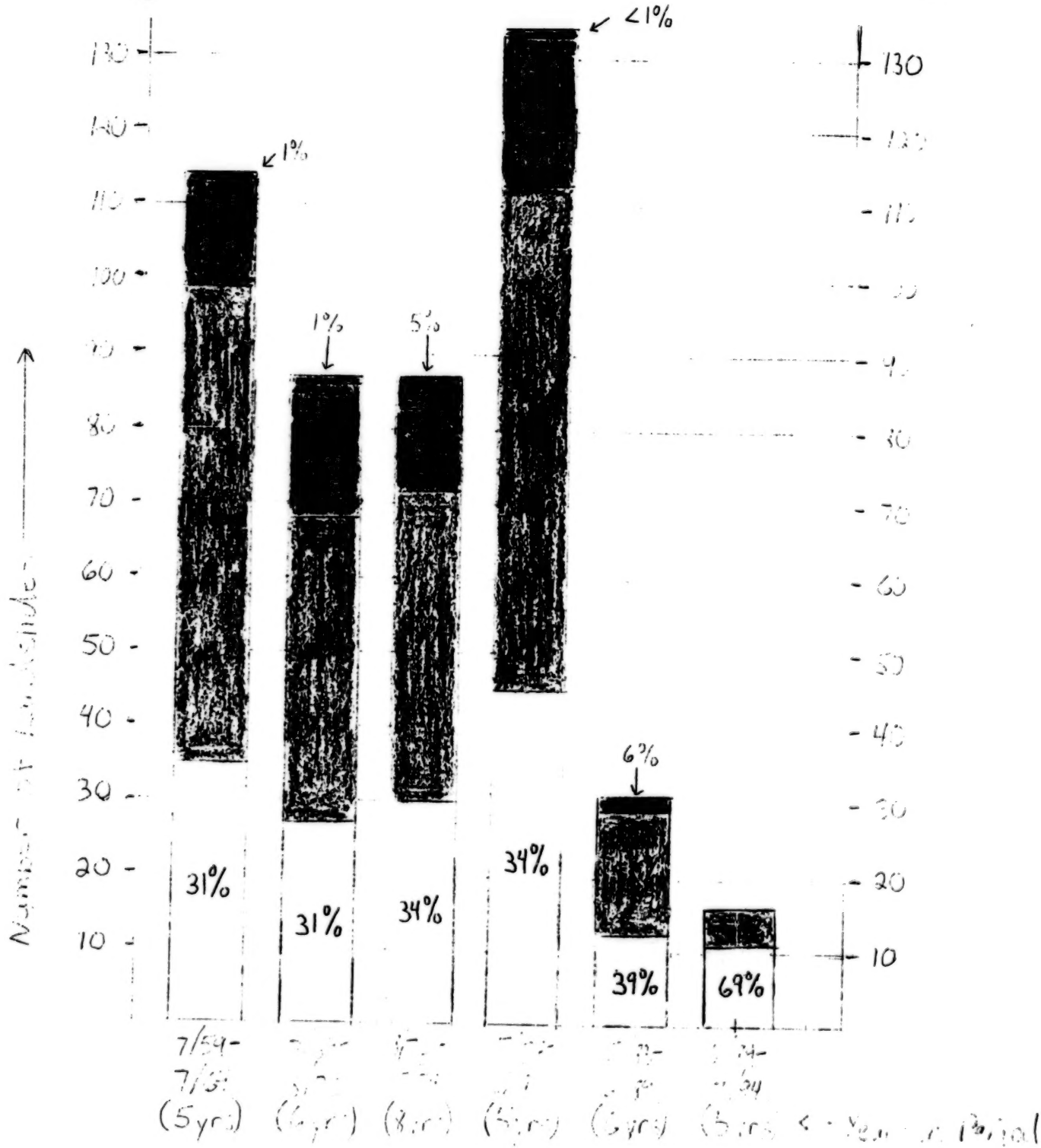
Yellow = Medium Size Landslide
(0.1 to 0.5 acres)

Orange = Large Landslide
(0.5 to 2.0 acres)

Red = Very Large Landslide
(2.0 to 5.0 acres)

Blue = Extremely Large Landslide
(greater than 5.0 acres)

Highest Order and Stream Reaches Handmade

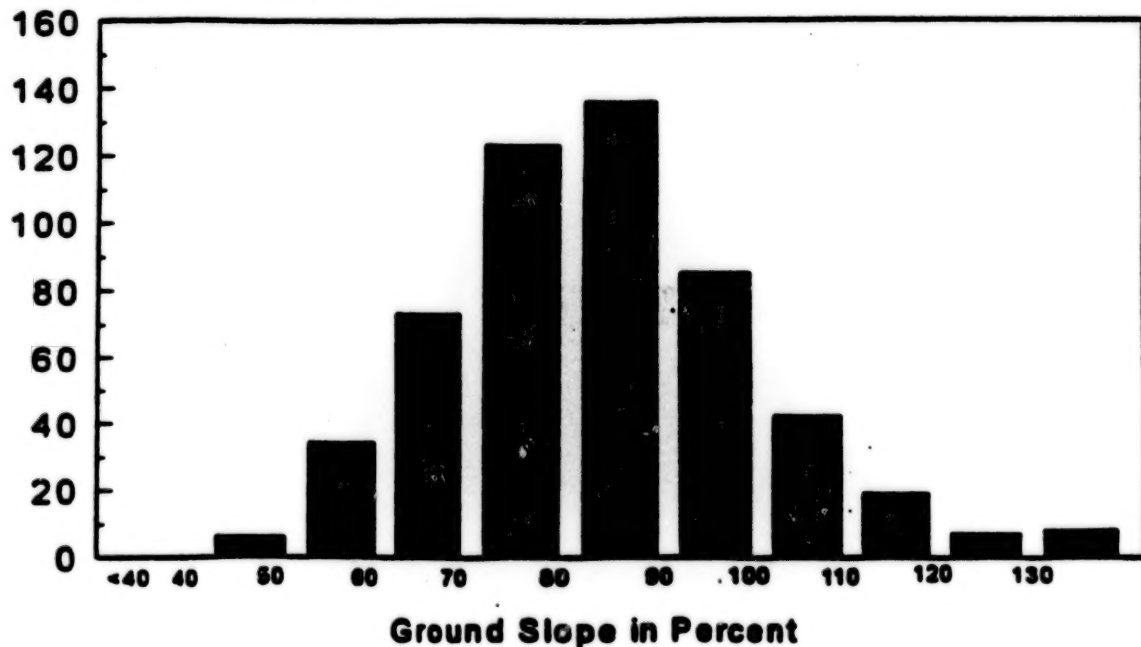


Yellow = No stream Reached
 Gray = 1st and 2nd Order Streams Reached
 Red = 3rd and 4th Order Streams Reached
 Blue = 5th and 6th Order Streams Reached

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Chart 6-7

Number of Landslides



Bar graph of "natural" slope steepness for all landslides (including road related) in the core study sites.

From page 29 of Storm Impacts and Landslides, Progress Report on the Oregon Department of Forestry Studies, January 20, 1998

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AQUATIC HABITAT AND FISH

A. Key Questions

- What is the distribution of fish species?
- What are their condition and trend?
- What is the current recruitment of CWD in the riparian areas?
- How could thinning within the riparian reserves enhance future stand development towards late successional characteristics?
- Which stream reaches are needing CWD left during riparian reserve treatments?
- Where would CWD inputs provide the greatest benefits to aquatic species?
- What specific road segments could be decommissioned, repaired or modified to reduce risks to aquatics?

B. Fish Distribution, Trends and Relative Importance of Streams to Fish

Figure 7-1 shows the current known fish distribution. Figures 7-2, 7-3, 7-4, 7-5, and 7-6 as well as Charts 7-1 and 7-2 and Tables 7-1, 7-2, and 7-3 show the past and present vegetation conditions across the Elkton-Umpqua WAU in riparian type habitat. Private lands are portrayed according to Oregon Forest Practices rules and federal lands are portrayed according to the Riparian Reserve system within the NFP. This data was compiled using the satellite imagery as explained under the previous Vegetation section. The same limitations that applied under the vegetation section also apply to this data. (See pages 3-1 and 3-2 under the Vegetation section for a discussion of the strengths and weaknesses of the data.) Table 7-4 shows Oregon Department of Fish and Wildlife (ODFW) survey data of stream habitat by specific stream reach.

In order to assess the existing and potential fisheries values, a modified Bradbury process was used to rank the various drainages in the Elkton-Umpqua WAU (Table 7-5). This ranking is designed to guide management actions such as road restoration and riparian thinning. Each of the factors have a potential score of one (low value, low priority for protection/restoration) to three (highest value, highest priority for protection/restoration). All of the subwatersheds are assumed to have cutthroat trout, and limited populations of coho salmon and steelhead. Because of the unknown distribution of coho salmon and chinook salmon, number of species present was not used as a factor. The factors used to rank the watersheds were as follows;

- 1) Relative abundance of habitat. In the absence of species data, amount of suitable habitat is considered to be an index of relative species abundance, and was therefore used as an indicator. Large amounts (>5 km) of low gradient habitat below natural barriers receives a higher score, and low amounts (<2 km) of low gradient habitat receives a lower score.
- 2) Relative integrity of the watershed. Road density and equivalent clearcut area (stands younger than 30 years) were used as indicators for this factor. Drainages with road densities less than 2.5 mi/mi² and ECA less than 15% received a value of 3. Drainages with road densities greater than 3.5 mi/mi² and ECA greater than 25% received a score of 1.
- 3) Habitat quality. ODFW aquatic habitat surveys were used for this indicator (Table 7-4). ODFW ratings of poor received a score of 1, fair received a 2, and good received a 3.
- 4) Relative risk. The predominant federal land use allocation was used as an indicator for this factor. If greater than 50% of the watershed is in LSR, the risk factor was 3 (low risk). If greater than 50% of the federal ownership is matrix, the relative risk factor is 1. If there is an equal mix, or a large amount of connectivity, the risk factor is 2.
- 5) Degree of optimism that federal actions will significantly affect habitat conditions. The amount of federal ownership was used as the indicator for this factor. If greater than 50% of the basin is in federal ownership, the optimism factor is 3. If less than 40% of the basin is in federal ownership the optimism factor is 1. If between 40-50% of the basin is in federal ownership, then the optimism factor is 2.

Each of the major fish bearing drainages are discussed individually below.

Hedden Creek. Fish presence has been documented as far as section 9, 4.71 km from the mouth. A steep portion of the stream in reach 2 probably limits anadromous fish use (relative abundance score=2). The road density is 5.1 mi/mi² and 26% of the watershed is less than 30 years (relative integrity score=1). Overall, ODFW surveys indicates "fair" aquatic

habitat (habitat quality factor=2). Over 90% of the federal LUA is LSR (relative risk score=3) and there is 38% federal ownership (optimism score=1).

Fitzpatrick. Fish presence has been documented for only 2.5 km from the mouth. There is probably a barrier to anadromous fish in section 11 on private land (relative abundance score=1). The road density is 4 mi/mi² and 26% of the watershed is less than 30 years (relative integrity score=1). Overall, ODFW surveys indicates "good" aquatic habitat (habitat quality factor=3). The federal LUA is 100% LSR (relative risk score=3) and there is 48% federal ownership (optimism score=2).

Martin Creek. Fish presence has been documented for only 2.13 km from the mouth. The stream gradient is relatively steep and there are numerous small falls (relative abundance score=1). The road density is 3.1 mi/mi² and a visual estimate indicates about 15% of the watershed is less than 30 years (relative integrity score=2). Overall, ODFW surveys indicates "fair" aquatic habitat (habitat quality factor=2). The federal LUA is close to 100% LSR (relative risk score=3) and there is 51% federal ownership (optimism score=3).

Mehl Creek. Fish presence has been documented for over 15 km from the mouth. This extends well into the headwaters in section 23. There are no known barriers to anadromous fish (relative abundance score=3). The road density is 3.3 mi/mi² and 13% of the watershed is less than 30 years (relative integrity score=2). Overall, ODFW surveys indicates "fair" aquatic habitat (habitat quality factor=2). The federal LUA is over 90% LSR (relative risk score=3) and 45% of the watershed is in federal ownership (optimism score=2).

Yellow Creek. Fish presence has been documented for 8.84 km from the mouth. Most of this is low gradient and probably important for anadromous fish (relative abundance score=3). The road density is 3.1 mi/mi² and 13% of the watershed is less than 30 years (relative integrity score=2). Overall, ODFW surveys indicates "fair" aquatic habitat (habitat quality factor=2). The federal LUA is about 75% LSR (relative risk score=2) and 55% of the watershed is in federal ownership (optimism score=3).

Little Canyon Creek. Fish presence has been documented for 5 km from the mouth. There are no known fish barriers but the stream gradient is relatively steep and probably has limited anadromous fisheries value (relative abundance score=2). The road density is 3.7 mi/mi². 16% of the Lost Canyon sub-watershed is less than 30 years, but a visual estimate for the Little Canyon drainage indicates that it is higher for the drainage (relative integrity score=2). Overall, ODFW surveys indicates "fair" aquatic habitat (habitat quality factor=2). The federal LUA is about 60% LSR (relative risk score=1) and 37% of the watershed is in federal ownership (optimism score=1).

Lost Creek. Fish presence has been documented for 6 km from the mouth. Based on gradient, an estimated 3 km are used by coho salmon (relative abundance score=2). The road density is 2 mi/mi². 16% of the Lost Canyon sub-watershed is less than 30 years, but a visual estimate for the Lost Creek drainage indicates that it is lower for the drainage (relative integrity score=3). Overall, ODFW surveys indicates "fair" aquatic habitat (habitat quality factor=2). The federal LUA is 100% LSR (relative risk score=1) and 47% of the watershed is in federal ownership (optimism score=2).

Brads Creek. Fish presence has been documented up to 3.4 km from the mouth. A potential barrier probably limits anadromous use to 3 km. A major tributary also supports a resident fish population (relative abundance score=2). The road density is 4.4 mi/mi². 26% of the sub-watershed is less than 30 years (relative integrity score=1). Overall, ODFW surveys indicates "poor" aquatic habitat (habitat quality factor=1). The federal LUA is mostly matrix (relative risk score=1) and 46% of the watershed is in federal ownership (optimism score=2).

McGee Creek. Fish presence has been documented up to 2.78 km from the mouth. The first 2 km probably supports an anadromous fish population, and from that point the stream gradient increases significantly (relative abundance score=2). The road density is 4.5 mi/mi², and 25% of the sub-watershed is less than 30 years (relative integrity score=1). Overall, ODFW surveys indicates "fair" aquatic habitat (habitat quality factor=2). The federal LUA is about half matrix (relative risk score=1) and 38% of the watershed is in federal ownership (optimism score=1).

C. Coarse Woody Debris and Riparian Reserve Management

1. Overall Characterization of Riparian Habitat

Riparian reserves serve several functions in the NFP (USDA, et al. 1994:B-13):

"...Riparian Reserves are used to maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transitions zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed.....provide a high level of fish and riparian protection..."

Riparian Reserves account for approximately 11,137 acres (37%) of the federal ownership in the WAU (Tables 7-3 and 1-2). Snags and CWD are a key component of fish habitat, within the streams, and the terrestrial ecosystem of the Riparian Reserves. These structures not only provide habitat necessary for the lengthy (time consuming) migration/gene flow of the less mobile plant and animal species but CWD is integral in habitat maintenance and formation within the stream channel, CWD dissipates and redirects stream energy, it provides cover for fish, shades the water, and is a large source of nutrients into the aquatic system. Although CWD of all sizes contribute to a healthy stream ecosystem, especially important are large diameter, long length pieces. Large pieces not only are less mobile in high flow events but they persist for a longer period of time. Of the federal Riparian Reserves approximately 5,881 acres (53%) are in late seral type habitat that are functional on a CWD/snag basis (Table 7-3, Charts 7-1 and 7-2) (same assumptions as in the Wildlife section).

The ability of a standing tree to become a functional piece of CWD within the stream channel is a function of several factors, the single biggest factor being distance from the stream. There are approximately 20,368 acres of area within riparian type habitat with 1,500 acres of that being water (Table 7-2). Satellite vegetation data shows approximately 7,518 acres (37%) of the total WAU currently functioning from a CWD/snag standpoint.

2. Characterization of CWD in Riparian Reserves

a. Coarse Woody Debris (CWD)

Table 7-6 was used in the South Coast - Northern Klamath Late Successional Reserve Assessment to describe CWD in Riparian Reserves (LSRA, pg. 88). It is based on published research to describe CWD in Douglas-fir forest in western Oregon and Washington (Spies *et al* 1988), and a masters thesis on riparian vegetation and abundance of woody debris in streams of southwestern Oregon (Ursitti, 1990).

Table 7-6

Range of Down Wood in Un-managed Forests, Oregon Coast Range
(Stand Age 80 - 150 Years)

Coarse Woody Debris Amounts for Coast Range	Within 200 Feet (1 Site Potential Tree) of Perennial Stream Cu. Ft./ Ac.	Beyond 200 Feet (1 Site Potential Tree) of Perennial Stream Cu. Ft./ Ac.
Range	3,500 - 9,500 ^a	1,600 - 2,300 ^b

^aUrsitti, 1990

^bSpies, 1988/1991

The LSRA for the Oregon Coast Province-Southern Portion (Table 7-7) describe levels of CWD as a volume reported by Spies and Franklin (Spies 1995), and as percent cover Carey (Carey, 1995).

Table 7-7

Range of Down Wood in Un-managed Forests, Oregon Coast Range
(Stand Age < 80 Years)

Coarse Woody Debris (CWD)	Cu. Ft./ Ac.	Percent Cover
Range	525 - 1979	2.5% - 5.1%
Average	1102	3.8%

As shown above and in other studies, existing CWD in stands is highly variable. Whether existing CWD in a particular Riparian Reserve is within the range of natural variability will depend to some extent on stand history.

The following Table 7-8 characterizes CWD components for stands that are less than 100 years old on the Roseburg District. These are either unmanaged young stands or stands that were harvested and received no other treatments. Many of the stands harvested in the 1950s had large amounts of snags and CWD left on site because of a lack of commercial value. These numbers can be compared with CWD conditions that occur in un-managed stands from Spies, 1995 data (Table 7-7).

Table 7-8

ROSEBURG DISTRICT UN-MANAGED STAND CONDITIONS¹
(from CFI plots, Stand Age 40-99 Years)

Major Plant Group (% Area Represented in WAU)	# of Plots	Types of Coarse Woody Debris							
		Sound		Soft		Rotten		Total	
		ft ³ /ac ²	Tons/ac	ft ³ /ac	Tons/ac	ft ³ /ac	Tons/ac	ft ³ /ac	Tons/ac
Mixed Conifer-Interior Valley-Grass (42%)	30	107	1.6	380	5.7	520	7.8	1007	15.1
Douglas fir-Mixed Brush-Salal (56%)	22	26.7	0.4	160	2.4	787	11.8	973	14.6

¹Down Log and Snag Component Analysis Tables, Roseburg District BLM, August, 1991

²Cubic feet/ acre converted from tons/ac based on 30 lbs/ft³ for D-fir @ 12% moisture

b. Trees Per Acre (TPA)

Based on timber cruise data from late seral stands in the Elkton-Umpqua WAU there would be an average of 53 TPA greater than 10 inches DBH, with a range of 37 to 71 TPA. Stands managed for intermediate harvests (commercial thinnings) will usually start with between 200 and 300 TPA. These are normally thinned to a density of 90 to 120 TPA.

The above information is used in the next section, **Restoration Opportunities and Management Recommendations** to discuss what kind of riparian management can more quickly develop late seral structures in riparian stands that currently are at the mid seral stage.

¹Down Log and Snag Component Analysis Tables, Roseburg District BLM, August, 1991

Elkton-Umpqua WAU**Prominent Streams and
Fish Distribution**

T21S

T22S

**MEHL
CREEK****ELKTON**

1 0 1 2 Miles

1:141277

T23S

**YELLOW
CREEK****MC GEE
CREEK****LEGEND**

- Fish Distribution
 Text Stream Names
 Subwatersheds
 Text Section
 Section Lines (Lli)
 Streams (3+ Order)
 Umpqua River
 Late Successional Reserves
 Other Reserves
 Matrix Lands
 Late Seral
 Mid Seral
 Early Seral
 Pending or Recent Cut Sales

T24S

**LOST
CANYON**

No warranty is made by the BLM
 for use of the data for purposes
 not intended by the BLM

R8W

R7W

R6W

Table 7-1

Elkton-Umpqua 1936 Riparian Vegetation by Subwatershed

	Agriculture Urban Lands		Burned Areas		Early Seral (0-30 Years)		Mid Seral (30-80 Years)		Late Seral (80+ Years)		No Data Available		Totals of WAU	
Subwatershed	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Elkton	598	14.7%	101	2.5%	107	2.6%	425	10.5%	2830	69.7%	0	0.0%	4061	20.0%
Lost Canyon	230	9.1%	0	0.0%	0	0.0%	271	10.7%	2031	80.2%	0	0.0%	2532	12.5%
McGee Creek	588	13.0%	0	0.0%	0	0.0%	333	7.4%	3609	79.7%	0	0.0%	4530	22.4%
Mehl Creek	2097	35.1%	0	0.0%	58	1.0%	1066	17.9%	2747	46.0%	0	0.0%	5968	29.5%
Yellow Creek	33	1.0%	59	1.9%	0	0.0%	1301	41.1%	1772	56.0%	0	0.0%	3165	15.6%
Total Elkton-Umpqua	3546	17.5%	160	0.8%	165	0.8%	3396	16.8%	12989	64.1%	0	0.0%	20256	100.0%

Table 7-2

Elkton-Umpqua 1992 Riparian Vegetation by Subwatershed (All Land Ownership)

	Agriculture Urban Lands		Hardwoods		Early Seral (0-30 Years)		Mid Seral (30-80 Years)		Late Seral (80+ Years)		Water		Totals of WAU	
Subwatershed	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Elkton	365	9.3%	198	5.1%	995	25.4%	818	20.9%	1540	39.3%	0	0.0%	3916	19.2%
Lost Canyon	136	5.5%	59	2.4%	260	10.5%	677	27.4%	1141	46.1%	201	8.1%	2474	12.1%
McGee Creek	448	10.0%	107	2.4%	1181	26.4%	866	19.3%	1410	31.5%	470	10.5%	4482	22.0%
Mehl Creek	1111	17.5%	277	4.4%	1409	22.1%	950	14.9%	1790	28.1%	829	13.0%	6366	31.3%
Yellow Creek	3	0.1%	57	1.8%	373	11.9%	1060	33.9%	1637	52.3%	0	0.0%	3130	15.4%
Total Elkton-Umpqua	2063	10.1%	698	3.4%	4218	20.7%	4371	21.5%	7518	36.9%	1500	7.4%	20368	100.0%

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Table 7-3

Elkton-Umpqua 1992 Riparian Vegetation by Subwatershed (Federal Ownership Only)

	Agriculture Urban Lands		Hardwoods		Early Seral (0-30 Years)		Mid Seral (30-80 Years)		Late Seral (80+ Years)		Water		Totals of WAU	
Elkton	1	0.0%	80	3.4%	636	26.6%	528	22.1%	1143	47.9%	0	0.0%	2388	21.4%
Lost Canyon	8	0.5%	30	1.9%	130	8.4%	439	28.4%	930	60.2%	7	0.5%	1544	13.9%
McGee Creek	28	1.3%	41	1.8%	577	26.0%	501	22.6%	1069	48.1%	5	0.2%	2221	19.9%
Mehl Creek	13	0.5%	100	3.9%	564	22.0%	558	21.8%	1310	51.2%	15	0.6%	2560	23.0%
Yellow Creek	0	0.0%	23	0.9%	275	11.3%	697	28.8%	1429	59.0%	0	0.0%	2424	21.8%
Total Elkton- Umpqua	50	0.4%	274	2.5%	2182	19.6%	2723	24.5%	5881	52.8%	27	0.2%	11137	100.0%

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ODFW Aquatic Habitat Inventory Data

Table 7-4

1	35.1	0.3	30.5	17	14	94	3.4	5.6
2	84.0	0.2	29.9	35	36	94	12.7	16.4
3	5.2	0.2	--	0	0	98	31.5	77.2
1	83.3	0.4	40.5	14	57	95	17.8	33.3
2	72.3	0.4	54.1	1	37	97	4.9	4.6
3	54.1	0.3	50.0	20	50	93	115.9	181.7
1	29.9	0.5	29.0	11	51	93	24.0	9.8
2	27.7	0.3	15.0	40	25	96	15.2	6.6
3	27.3	0.4	38.3	70	20	86	7.5	6.3
4	24.0	0.3	19.0	4	40	95	11.8	7.1
5	45.1	0.2	19.6	19	35	87	24.8	44.6
1	48.7	0.4	15.7	10	73	90	4.1	5.7
2	15.0	0.2	--	4	62	95	5.5	10.6
3	16.6	0.2	--	2	52	98	21.1	43.0
4	3.0	0.2	--	11	47	99	24.1	56.0
1	31.0	0.4	26.0	0	48	86	5.9	7.7
2	69.8	0.3	--	2	72	66	2.1	0.9
3	42.8	0.3	31.0	5	75	91	8.9	19.0
4	13.3	0.3	--	16	41	92	24.8	55.0
5	15.7	0.5	--	5	43	92	17.3	57.9
6	6.1	0.3	5.0	4	54	93	23.1	129.0
1	45.7	0.4	80.0	5	57	99	12.0	16.4
2	53.4	0.3	35.3	5	67	96	21.1	38.4
3	0	0	--	0	0	91	35.4	26.8
1	51.5	0.4	38.0	16	67	97	6.1	7.6
2	60.8	0.6	20.4	15	38	82	3.3	2.9
3	25.7	0.5	19.7	20	58	96	18.5	87.2
4	--	0	--	--	--	75	9.2	38.0
1	58.6	0.5	48.1	22	44	92	15.6	7.5
2	90.5	0.5	--	10	45	91	8.9	5.7
3	66.1	0.5	89.3	4	44	84	19.5	13.5
4	52.2	0.4	33.3	10	43	87	17.1	25.4
1	70.9	0.5	90.3	5	28	92	13.5	5.8
2	64.1	0.4	64.6	5	26	96	14.8	9.7
3	63.5	0.4	60.3	6	44	97	13.4	11.3
4	23.3	0.3	--	4	38	100	16.0	25.8
5	0	0	--	0	0	100	16.0	11.0
1	55.2	0.6	37.5	9	42	77	2.8	3.9
2	24.0	0.5	43.4	6	48	85	6.9	13.7
3	64.2	0.5	22.8	20	72	79	18.0	52.6
4	83.2	0.5	22.0	3	97	82	17.6	30.7
5	22.9	0.3	18.1	2	75	89	14.9	44.1
6	7.3	0.2	11.0	0	80	85	25.6	54.1

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Table 7-5

Fish/Stream Modified Bradbury Ranking

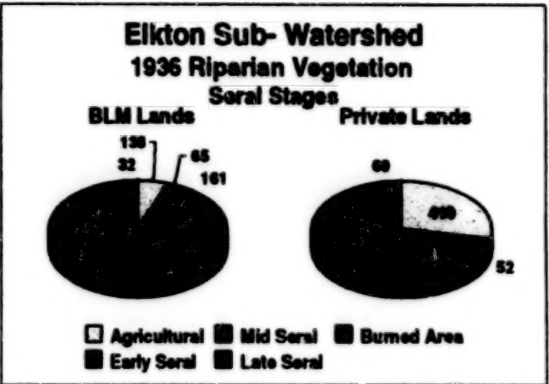
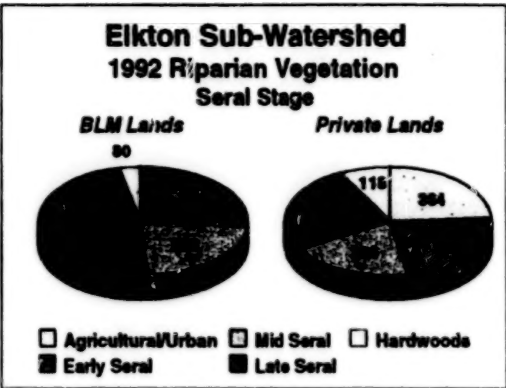
Stream	Habitat Abundance	Relative Integrity	Habitat Quality	Risk	Opportunism	Total
Brick Creek	2	1	1	1	2	7
Clear Fork Creek	1	1	3	3	2	10
Hammer Creek	2	1	2	1	1	7
Hickory Creek	2	1	2	1	1	7
Little Canyon Creek	2	2	2	1	1	8
Little River Fork	2	3	2	2	3	12
Looney Creek	2	3	2	3	2	12
Mammoth Creek	1	2	2	3	3	11
MEC Creek	2	1	2	1	1	7
Ment Creek	3	2	2	3	2	12
Wagon Creek	2	1	2	1	1	7
Yellow Creek	3	2	2	2	3	12

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Elkton Sub Watershed

1992 Riparian Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	1	384
Early Seral	638	359
Mid Seral	528	290
Late Seral	1143	387
Hardwoods	80	118
Water		1

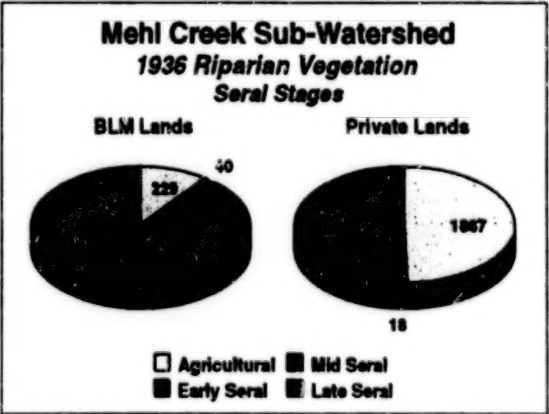
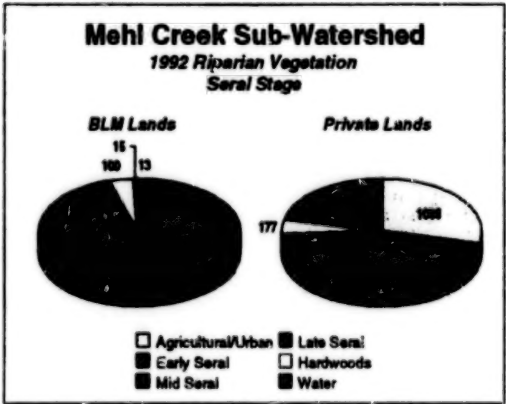
1936 Riparian Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural	138	460
Early Seral	65	52
Mid Seral	161	284
Late Seral	2055	775
Burned Area	32	69



Mehl Creek Sub-Watershed

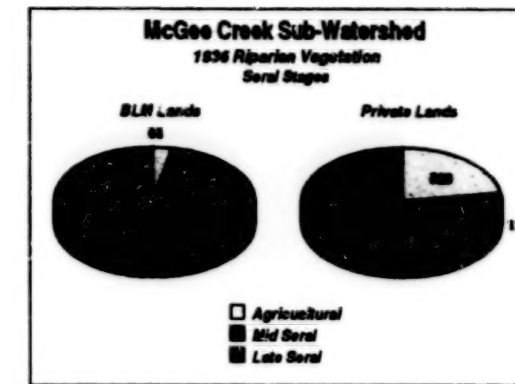
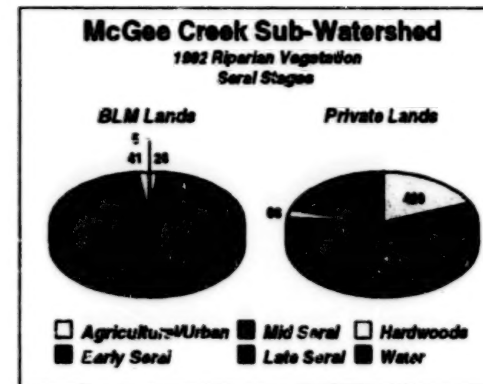
1992 Riparian Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	13	1098
Early Seral	564	845
Mid Seral	558	392
Late Seral	1310	480
Hardwoods	100	177
Water	15	814

1936 Riparian Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural	229	1887
Early Seral	40	18
Mid Seral	395	671
Late Seral	1536	1211



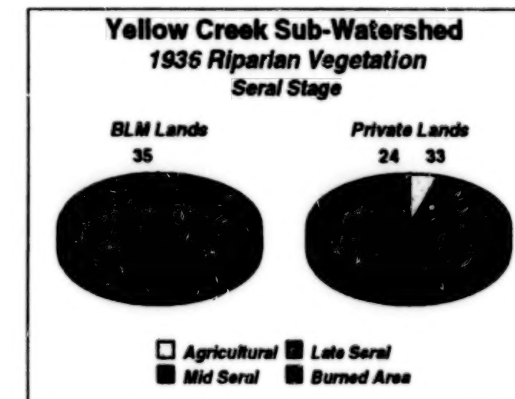
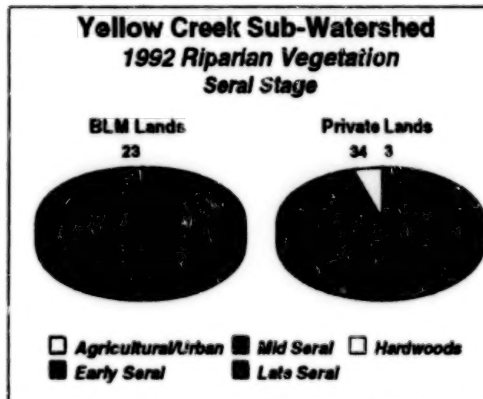
McGee Creek Sub-Watershed

1992 Riparian Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	28	420
Early Seral	577	804
Mid Seral	501	385
Late Seral	1089	341
Hardwoods	41	6
Water	5	465
1936 Riparian Vegetation Seral Stage		
Agricultural	88	520
Mid Seral	204	129
Late Seral	1930	1679



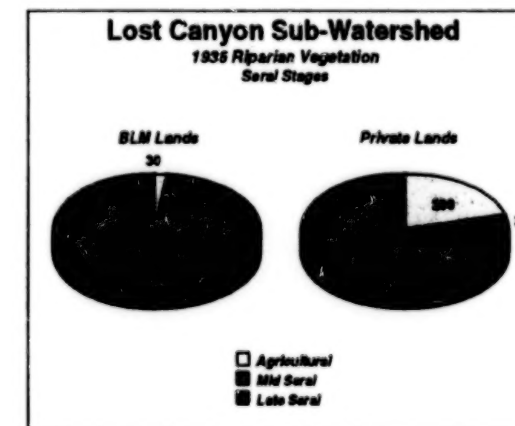
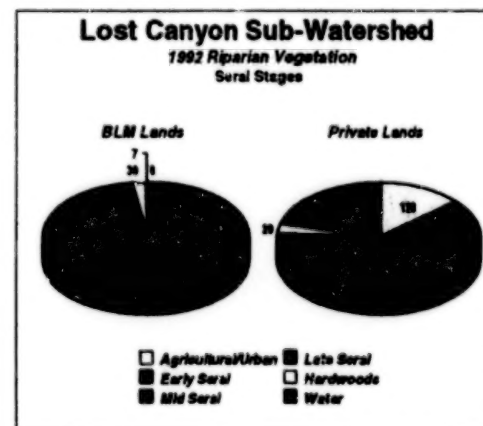
Yellow Creek Sub-Watershed

1992 Riparian Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban		3
Early Seral	275	98
Mid Seral	687	363
Late Seral	1429	208
Hardwoods	23	34
1936 Riparian Vegetation Seral Stage		
Agricultural		33
Mid Seral	1153	148
Late Seral	1246	526
Burned Area	35	24



Lost Canyon Sub-Watershed

1992 Riparian Vegetation Seral Stage	BLM Lands Total Acres	Private Lands Total Acres
Agricultural/Urban	8	128
Early Seral	130	130
Mid Seral	430	238
Late Seral	930	211
Hardwoods	30	29
Water	7	195
1936 Riparian Vegetation Seral Stage		
Agricultural	30	200
Mid Seral	234	37
Late Seral	1299	732



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RESTORATION OPPORTUNITIES AND MANAGEMENT RECOMMENDATIONS

The following recommendations are for the most part directed at processes that are within the influence of the BLM on federally administered lands. For any recommendations involved with those processes that may affect beyond property lines, the recommendations are not meant to preempt the objectives of individual landowners. Also these recommendations are given with the realization that other watersheds, such as Smith River, Rock Creek, and Canton Creek, will have a higher funding priority for restoration. It is assumed that most funding for restoration in Elkton-Umpqua WAU will come from revenue generating projects (ie. timber sales).

A. Human Uses/Fire Recommendations

Due to the large percentage of private lands intermingled with the scattered BLM lands, all fires should be suppressed immediately. The DFPA provides protection activities for the BLM and industrial forest land owners. Continue with rapid initial attack efforts on all fires to protect the existing resource values, and reduce potential liability to the BLM from fire spreading on to private land. Because of the high value of roads for quickly accessing initial fires, the transportation management objectives for all roads in this WAU should take this into consideration (see Road Restoration and Transportation Management Objectives below).

Transportation management objectives for roads should balance the need for fire protection and human uses against the impacts those roads may be having on fish and wildlife resources.

All activity fuels created by logging, thinning, etc. should be treated to reduce fuel hazard and fire risk. Treatment could include burning (broadcast, handpiling, swamper), gross yarding of unmerchantable material and tops not needed to meet large woody debris requirements, lopping and scattering of tops and limbs, and other treatments to reduce activity fuels.

It is recommended that federal land managers continue efforts to establish and nurture direct communications with private landowners prior to implementing actions affecting the landowners, particularly regarding road use and access. Improvements to the watershed can be more effective with private landowners' cooperation, given the checkerboard land tenure pattern. Listening and guiding, rather than dictating, is also recommended.

B. Restoration of Vegetation and Late Successional Dependent Terrestrial Wildlife Habitat

Strive to minimize disruptions to the dispersal patterns, including, identifying key areas, necessary to facilitate dispersal throughout the watershed. Dispersal of species/gene flow between LSRs is integral for the success of LSRs in maintaining viable populations of LSOG associates. Harvest/treatment units should be placed to minimize disruptions of these flows. This may involve avoidance of key areas until other stands mature sufficiently to provide the necessary linkages.

Minimize loss of interior, late seral habitat when placing regeneration units. In the past, management of wildlife species has encouraged the creation of "edge". Management for LSOG associates should discourage the creation of "edge". Fewer, larger harvest units, with regular boundaries have less impact than many, smaller, irregular shaped units. Placement of units should be on the periphery of large block of late seral to further limit impacts to interior habitat.

Manage early and mid seral habitat with LSRs to accelerate development of late seral characteristics. This may include treatments to accelerate diameter growth, retention/creation of large diameter limbs with deep crowns, development of snags and CWD components, development of multiple cohorts/canopies, enhanced species diversity, and introduction of defect (broken tops, dead tops, cavities in live stems, etc.) into stands.

C. Hydrological Restoration

In order to maintain stream temperatures, streambank stability, and protection from potential surface erosion, a minimum 20-foot no cut buffer is recommended for all intermittent streams within proposed commercial thinning units. Larger no-cut buffers along streams may be necessary depending on stream morphology, aspect, potentially unstable streambanks and headwater areas, landform, and concerns for fish in order to protect on-site and downstream beneficial uses.

D. Aquatic Habitat

1. Riparian Reserve Management Recommendations

a. GOALS

Long Term: To obtain functioning snags and CWD in Riparian Reserve stands that are within the range of natural variation found in un-managed natural stands.

Short Term: To maintain, produce, or enhance late seral structures (CWD, snags) in Riparian Reserves. Protect all existing CWD and snags and manage the live trees so that late seral structures persist through time and mimic natural conditions.

b. Using Existing Information for Riparian Reserve Evaluation

From a management feasibility stand point, out of approximately 11,137 acres (Table 7-3) of Riparian Reserves in Elkton-Umpqua WAU, it is estimated that only about 25% could actually be treated over time. This leaves 75% of Riparian Reserves to develop on their own. Add to that the variability of CWD amounts on the ground, there are a variety of objectives that management in Riparian Reserves could meet.

Using the information in the **Aquatic Habitat and Fish** section on CWD as a guide, management activities in young overly dense stands within Riparian Reserves would be planned to more rapidly develop late seral characteristics that contain large trees, snags, and CWD. But managing for the development of snags and CWD over time in Riparian Reserves is a complex matter. There are several factors that need to be considered in meeting the above goals. These include:

- Existing amounts of CWD
- How much if any CWD would be created in Riparian Reserves by cutting and leaving trees. (eg. larger amounts now versus smaller amounts over time).
- What is the optimal piece size for CWD.

With any management or lack of management in Riparian Reserves, there are trade-offs. These trade-offs include the following:

1) Greater Amounts of Induced CWD

- Increased fire hazard.
- Potential increase in Douglas-fir bark beetle populations which prefer to breed in large down material. These increased populations can attack and kill large numbers of healthy standing trees.

2) Lessor Amounts of Induced CWD.

- Less opportunities for meeting objectives with animals and plants that use CWD.
- Potential lowered impacts in sedimentation to streams.

Most of these trade-offs would need to be discussed at the project level and have objectives set accordingly.

Table 8-1 shows an example of how different prescriptions can influence stand development. The type of desired stand would depend on the fisheries or wildlife objectives.

Table 8-1

ORGANON Projections of Overstory Tree Characteristics

Stand Age	TPA	Average Diameter (in)	Max. Diameter (in) (# of Trees)	Crown Closure (%)	Volume (ft ³ /ac)
Current Stand					
56	213	13.9	24 (3)	98	8617
Light Thinning					
56	130	16.3	24 (3)	63	7176
71	127	19.6	28 (1)	100	12346
71*	100	20.6		90	10821
86	98	22.8	30 (4)	100	14664
86*	65	24.7		82	11382
101	64	26.7	34 (1)	100	14446
101*	30	30.6		79	8253
121	30	32.9	36 (2)	100	10914
Moderate Thinning					
56	100	16.8	24 (3)	54	7618
71	98	20.8	28 (1)	100	10766
71*	75	21.9		89	9117
86	74	24.4	33 (1)	100	12689
86*	50	26.0		100	12533
101	49	28.0	36 (2)	102	12533
101*	31	30.2		74	8608
121	30	33.0	38 (1)	100	11354
Heavy Thinning					
56	40	19.2	24 (2)	30	3196
71	40	24.0		79	5830
86	40	27.7		100	8548
101	39	30.3		100	11176
121	39	33.0	42 (1)	100	14494
Control					
56	213	13.0	24 (3)	100	8617
71	198	16.9		100	14031
86	195	17.5		100	18127
101	180	19.8		100	21594
121	170	21.1	34 (1)	100	24631

* Stand conditions immediately after thinning

Based on the Roseburg District Un-managed Stand data in Table 7-8 (pg 7-4), the existing amounts of CWD in the Elkton-Umpqua WAU are within the natural range of variability (Table 7-7). It would not take much additional CWD (leaving cut trees on the ground) to obtain the average amount of CWD in un-managed stands represented in Table 7-7 if that were the objective. One 20 inch dbh tree at a height of 120 feet to a 4 inch top would represent approximately 90 cubic feet. If one of these trees were cut and left on the ground, it would place the Douglas fir representative sample in the mid-range for CWD of an un-managed stand. This would not necessarily be the objective for a particular project but is only used as one possible example.

Other LSRAs (eg. South Cascades, February, 1998) use the concept of percent ground cover as the target measure for obtaining CWD amounts. As an example the South Cascade LSRA recommended 1 percent of ground cover be added to existing CWD in forest stands less than 50 years of age. This would translate to 12 to 15 TPA (pg 135-136). Existing

CWD on site in young managed stands, within the Elkton-Umpqua WAU, seems to be within natural variability leaving 12 TPA for CWD in most cases would not be necessary.

The South Coast - Northern Klamath LSRA acknowledged that with current managed stands it may not be possible to meet CWD within natural variability as shown in Table 7-6 at age 80 years. It used the following example as a possible management scenario for managed second growth stands:

The objective for the density management activity in a 40 year old stand is to end up with 80 TPA at age 80. The prescription is to remove trees down to 90 TPA at age 45. The current down wood levels are 3,000 cu.ft./acre and the desired level at age 80 is 5,000 cu.ft./acre. In order to provide adequate down wood at age 80, it may be necessary to leave an additional 10 TPA over the prescribed 90 to contribute to future goals. It is recommended that at the time of initial treatment no more than 20% of the additional trees be felled/girdled. The remaining trees are expected to provide future down wood resulting from suppression mortality or future scheduled treatments (felling/girding)

The possible number of trees treated to become snags and/or be left on the ground for sound CWD could range from 0 to 12 per acre depending on site specific wildlife and fisheries objectives. The Elkton-Umpqua ID team suggests using the above information as a framework for management in Riparian Reserves and use the following process for site specific projects.

c. Process for Evaluating Mid Seral Stands of Riparian Reserve for CWD

- 1) Measure/estimate existing amounts of CWD during pre-planning stand exams in Riparian Reserves.
- 2) Set wildlife and fisheries objectives for desired amounts and types of CWD and snags in Riparian Reserves in the Environmental Assessment (EA).
- 3) Initially mark Riparian Reserve stands according to silvicultural prescription.
- 4) Re-measure Riparian Reserves 2 to 4 years after harvest and implement projects to achieve objectives established in the EA for CWD.

2. Road Risk Assessment, Objectives, and Restoration Opportunities

Elkton-Umpqua WAU is estimated to have 586 miles of road (Table 5-2). Because this estimate only considers roads within the BLM database, and does not take into consideration many roads on private lands, it is most likely a low estimate. Road densities averaged 4.2 miles per square mile. The process below is meant to outline the highest priority BLM roads for decommissioning and road restoration work.

Many of the BLM roads within Elkton-Umpqua WAU are intermingled with privately owned or controlled road segments. An interdisciplinary process was developed to evaluate and rate each road segment for its impacts to aquatics as well as its current and future human uses. In this analysis because of time limitations only the Elkton, Mehl Creek and Yellow Creek subwatersheds were evaluated. These were evaluated first because of the higher ranked drainages for fish (see Table 7-5) as well as to prioritize possible road work to minimize impacts to aquatic species. Except for the Lost Creek drainage, these subwatersheds had some of the highest ranked drainages for fish species. This evaluation provides guidance for where teams can focus their best efforts for work on BLM controlled roads.

The roads were placed in the following categories: decommission candidates, high risk roads that had high human use associated with them, roads with portions having higher risk for road failures, erosion problem roads, and roads with stream crossing inventory needs. Some of these categories may be overlapping but this inventory is meant to be a guide for more site specific analysis. Roads that posed the highest risk to aquatics were either categorized for decommissioning or as high risk. Because the high risk roads also had high value for human uses, they would be maintained as open but should be given higher priority for risk reduction road renovation work. The roads in Yellow Creek and Elkton are represented in Figures 8-1 through 8-10. The information for the Mehl Creek subwatershed roads on the east side of the Umpqua River is still being developed. In the Yellow Creek subwatershed approximately 5.7 miles and in the Elkton

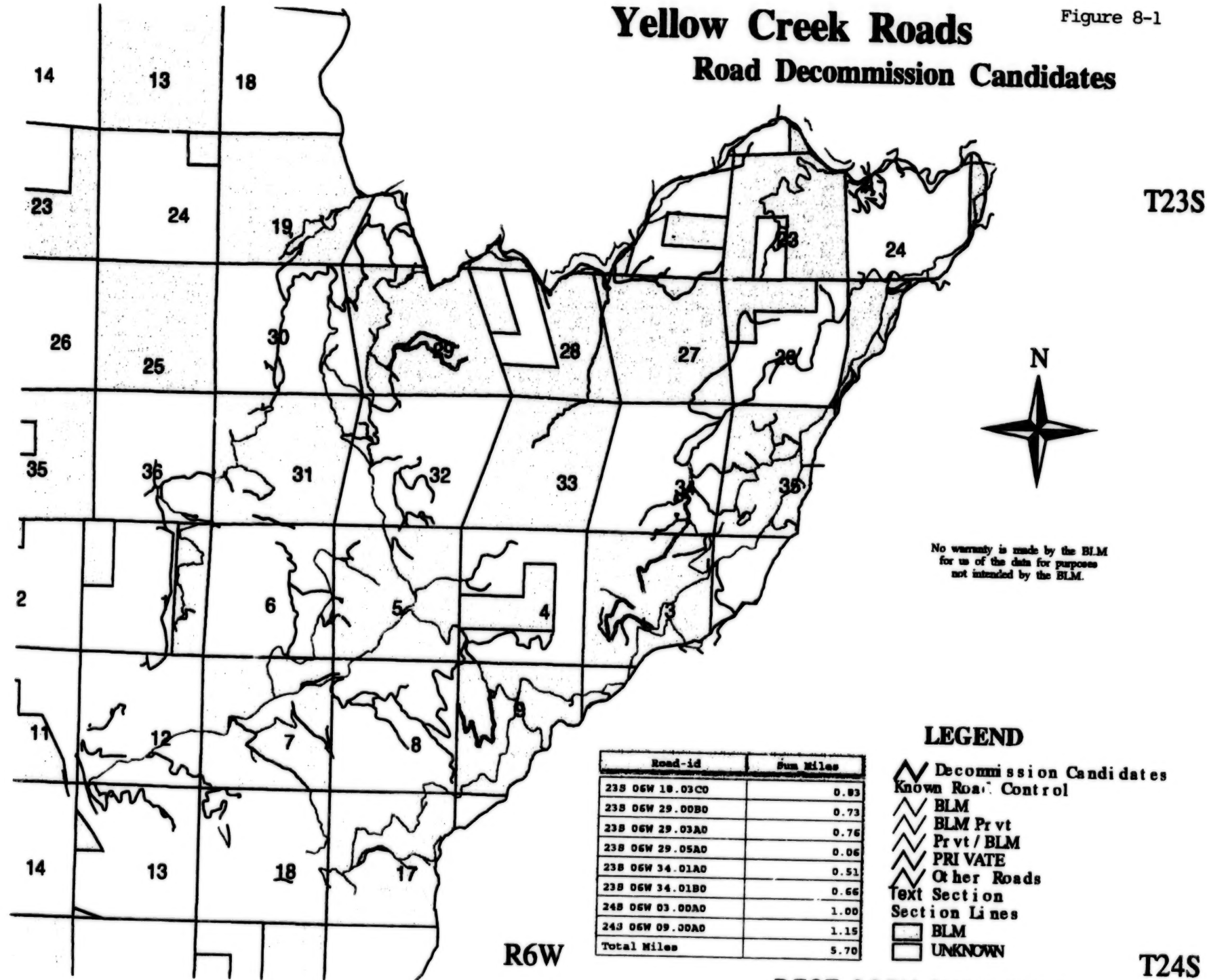
subwatershed approximately 3.7 miles are proposed as candidates for full decommissioning (Figures 8-1 and 8-6). These are roads that are for the most part owned and controlled by BLM.

The next step in this process is for the ID team to further refine which roads would be proposed to Douglas Fire Protection Association (DFPA) and Right-of-Way (R/W) permittees for decommissioning. This process would possibly be completed under a timber sale and would allow DFPA and R/W permittees to give their feedback for roads that they need for current and future access. Finally an environmental assessment would give the public an opportunity to comment on a final list of roads proposed for decommissioning.

Coos Bay District has developed some transportation management objectives for BLM roads within their administrative unit (Table 8-2). These roads are within portions of the Mehl Creek and McGee Creek subwatersheds west of the Umpqua River. They have categorized roads as either candidates for decommissioning or to be left open and maintained. Many of the roads that are classified for decommissioning are being closed with a large berm or barrier at the beginning of the road but culverts have not yet been pulled nor has the road been subsoiled to reduce hydrologic impacts. These types of actions will be further evaluated by the Coos Bay District and completed at a later date.

Yellow Creek Roads
Road Decommission Candidates

Figure 8-1

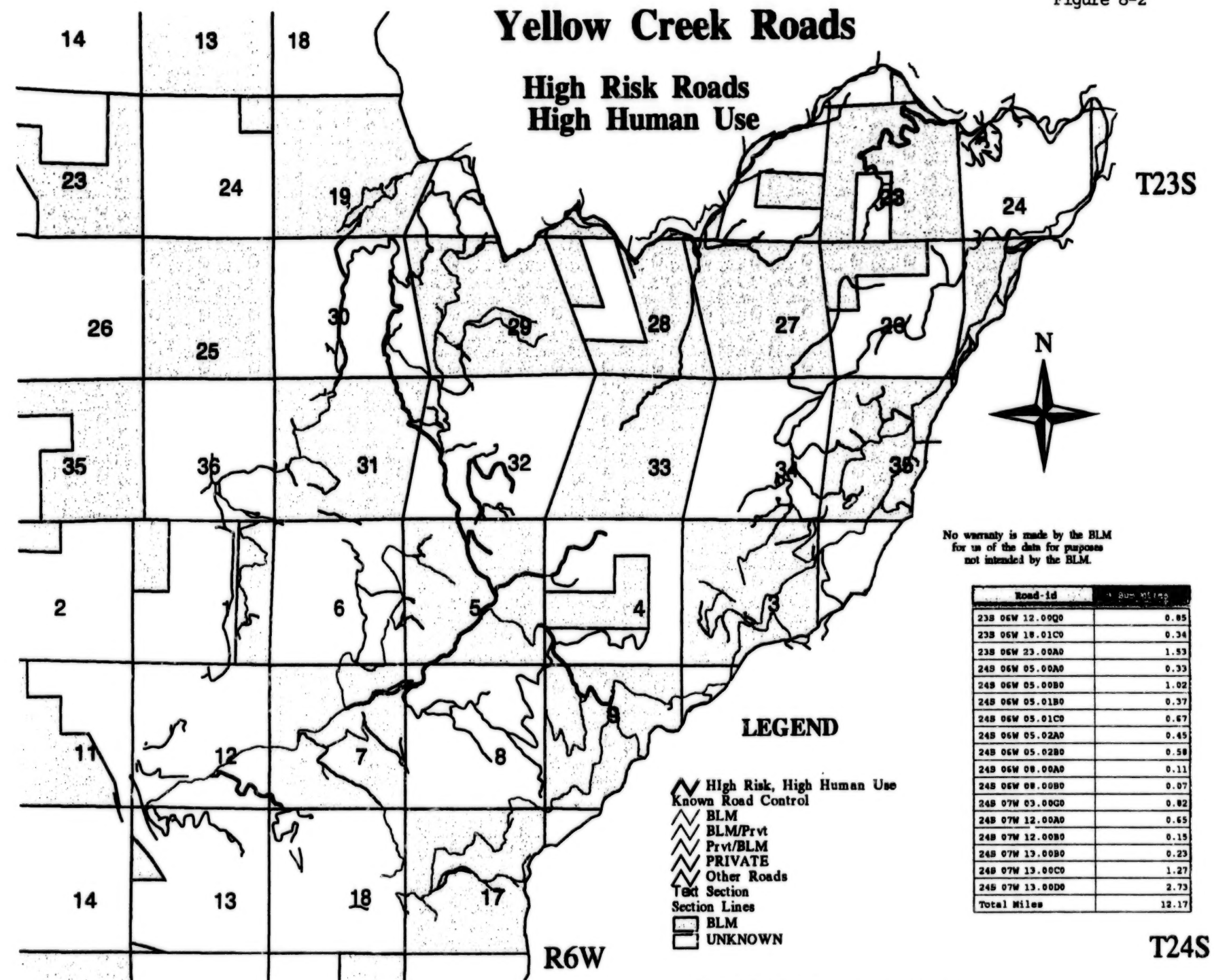


8-6

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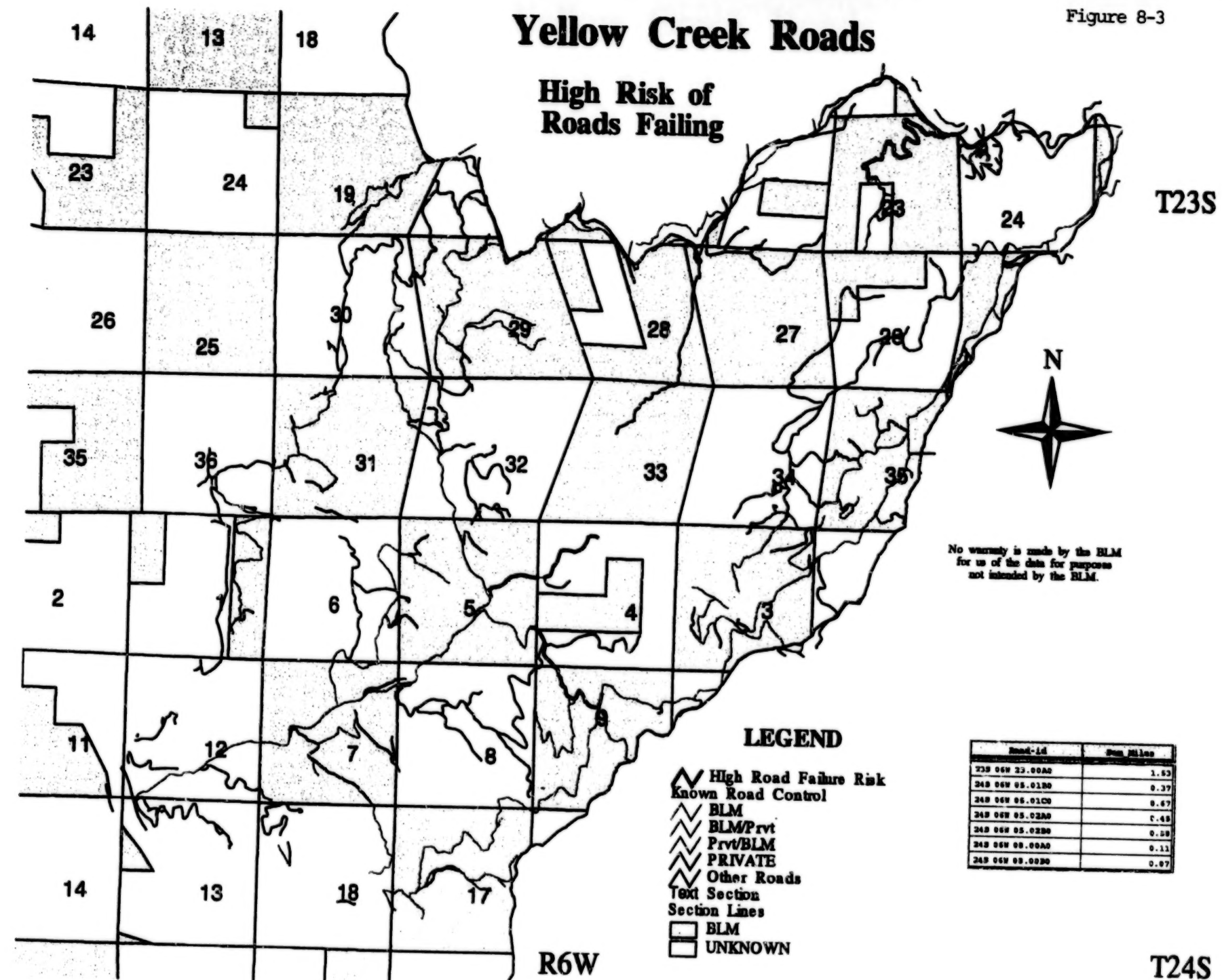
Figure 8-2



8-7

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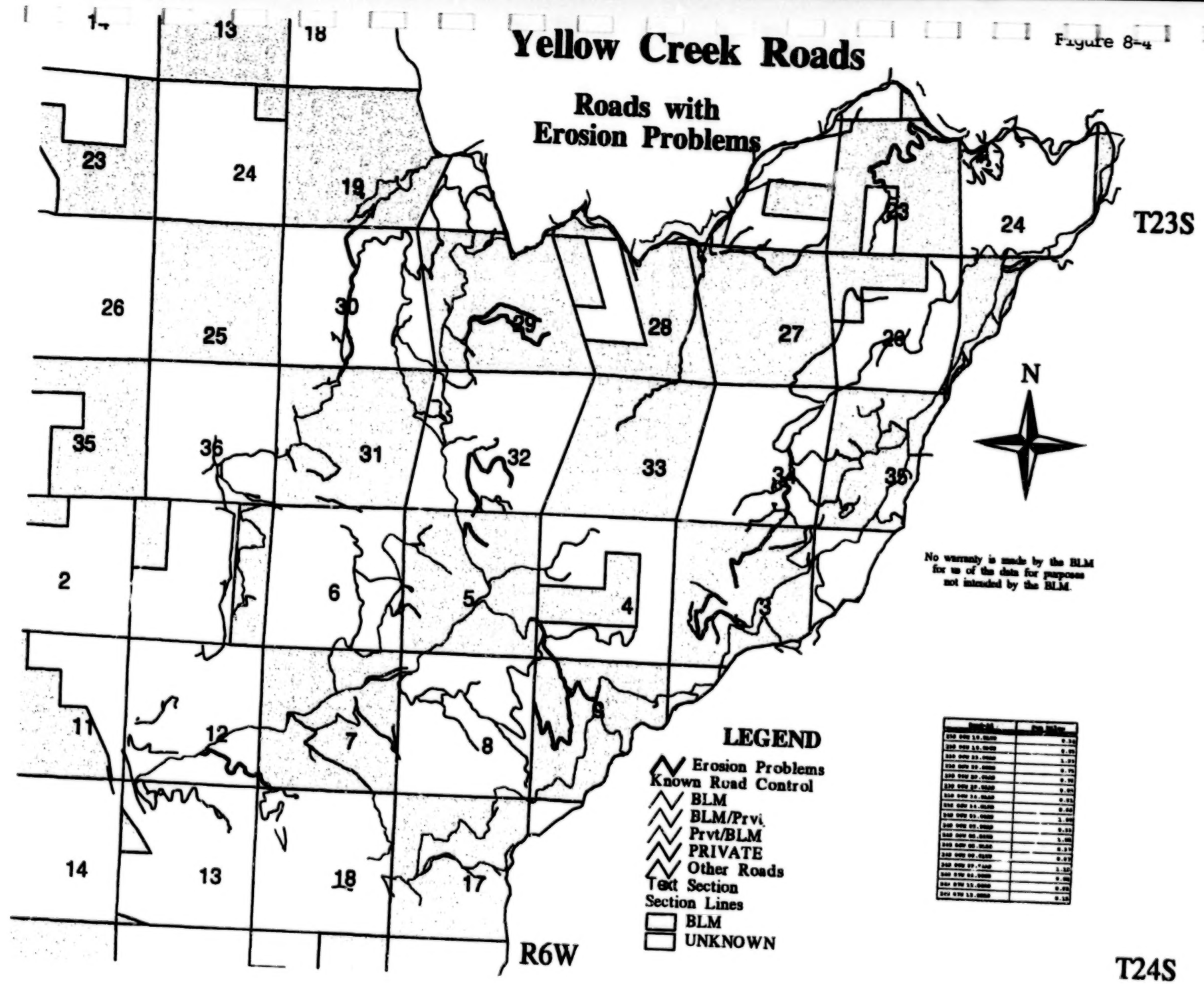
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Yellow Creek Roads

Figure 8-4

Roads with
Erosion Problems



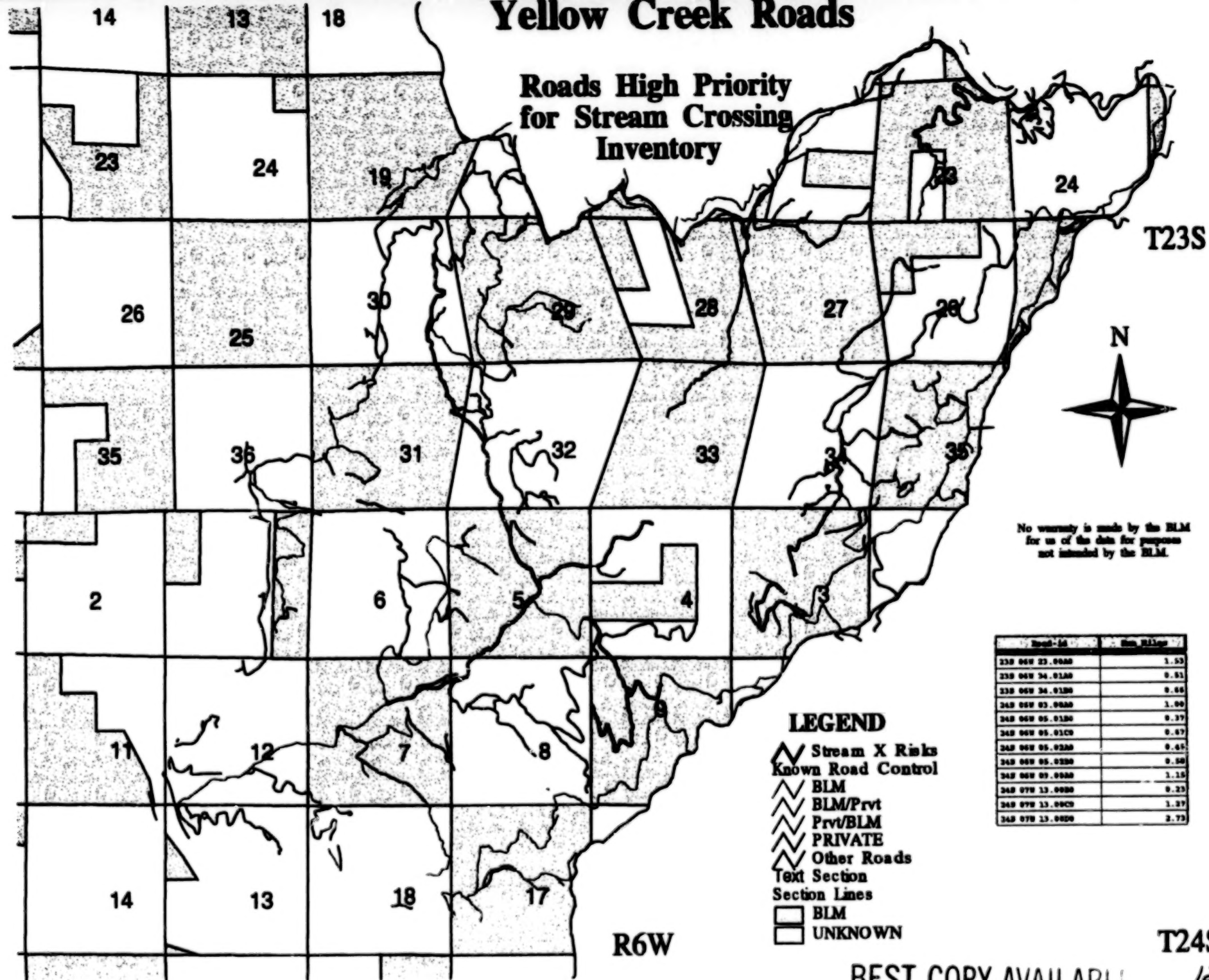
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Yellow Creek Roads

Roads High Priority for Stream Crossing Inventory



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LEGEND

- Stream X Risks
- Known Road Control
- BLM
- BLM/Prvt
- Prvt/BLM
- PRIVATE
- Other Roads
- Text Section
- Section Lines
- BLM
- UNKNOWN

Section-Id	Area Miles
23S 06W 23.0000	1.53
23S 06W 24.0100	0.51
23S 06W 24.0200	0.46
24S 06W 03.0000	1.00
24S 06W 05.0100	0.37
24S 06W 05.0200	0.47
24S 06W 05.0300	0.45
24S 06W 05.0400	0.50
24S 06W 07.0000	1.15
24S 07W 13.0000	0.23
24S 07W 13.0100	1.27
24S 07W 13.0200	2.73

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Elkton Subwatershed Roads

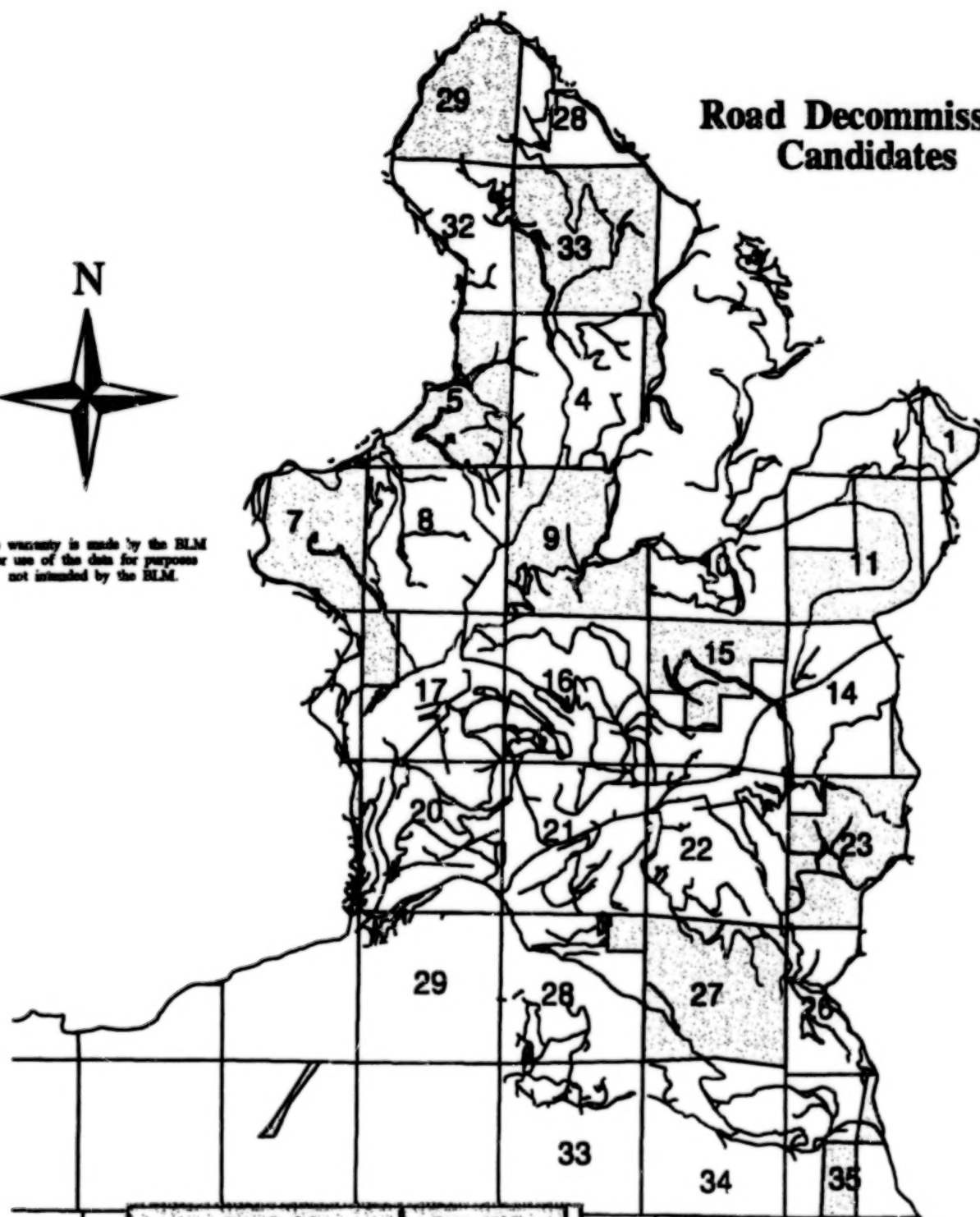
T21S

Road Decommission Candidates

N



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T22S

Road-Id	Sum Miles
22S 07W 04.00A0	0.53
22S 07W 04.00__	0.48
22S 07W 05.00A0	0.78
22S 07W 14.00G1	0.05
22S 07W 17.02__	0.97
22S 07W 23.01BZ	0.85
Total Miles	3.66

LEGEND

- Decommission Candidates
- Known Road Control
- BLM
- BLM/Prvt
- Prvt/BLM
- PRIVATE
- Other Roads
- Ownership
- BLM
- Other

R7W

Elkton Subwatershed Roads

T21S

High Risk Roads
High Human Use

T22S

N



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Road-id	Surface-ty	Control	Sum miles
22S 07W 02.05A0	NAT	PV	0.30
22S 07W 11.00A0	NAT	PB	0.62
22S 07W 12.00B0	NAT	BL	0.44
22S 07W 12.00C0	NAT	PV	0.23
22S 07W 14.00A0	ASC	BP	0.56
22S 07W 14.00B0	ASC	BL	1.61
22S 07W 14.00C0	ASC	PV	0.51
22S 07W 14.00D0	ASC	PV	0.64
22S 07W 17.00B0	NAT	SL	0.23
22S 07W 17.00C0	NAT	PB	0.76
22S 07W 20.00A0	ASC	PV	1.39
22S 07W 20.00C0	ASC	PV	1.43
22S 07W 22.00A0	ASC	PH	0.44
22S 07W 22.01B0	ASC	PV	0.95
22S 07W 22.01C0	ASC	BP	0.65
22S 07W 22.01D0	ASC	PB	0.86
22S 07W 22.01F	ASC	SL	0.87
22S 07W 22.01P0	ASC	BL	0.33
22S 07W 22.02A0	ASC	PB	0.34
22S 07W 22.02A1	ASC	PB	0.48
22S 07W 22.03A0	NAT	PV	0.09
22S 07W 22.03B0	NAT	BP	0.08
22S 07W 22.04A0	ASC	BL	0.97
22S 07W 23.00A0	NAT	BL	0.62
22S 07W 23.01A0	NAT	PB	0.47

LEGEND

- High Risk, High Human Use
- Known Road Control
- BLM
- BLM/Prvt
- Prvt/BLM
- PRIVATE
- Other Roads
- Ownership
- BLM
- Other

R7W

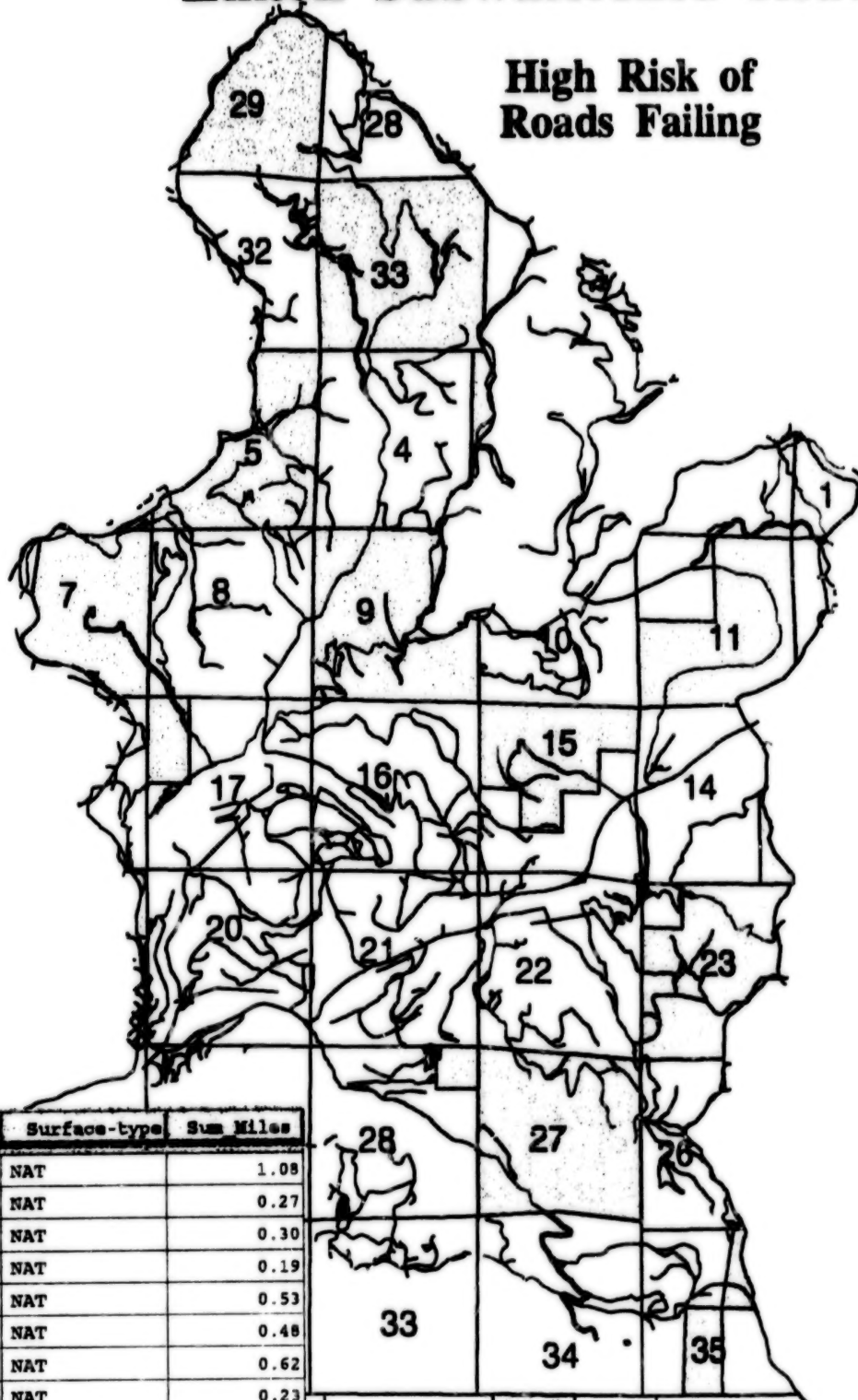
Elkton Subwatershed Roads

High Risk of Roads Failing

T21S



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T22S

Road-id	Surface-type	Sum Miles
21S 07W 33.00__	NAT	1.08
22S 07W 02.02B0	NAT	0.27
22S 07W 02.05A0	NAT	0.30
22S 07W 02.05B0	NAT	0.19
22S 07W 04.00A0	NAT	0.53
22S 07W 04.00__	NAT	0.48
22S 07W 11.00A0	NAT	0.62
22S 07W 17.00B0	NAT	0.23
22S 07W 17.02__	NAT	0.97
22S 07W 20.00C0	ASC	1.15
22S 07W 22.01F0	ASC	0.33
22S 07W 22.01I	ASC	0.14
22S 07W 23.01A0	NAT	0.47
22S 07W 34.00A		0.30

LEGEND

- ✓ High Risk, Road Failure
- Known Road Control
- BLM
- BLM/Prvt
- Prvt/BLM
- PRIVATE
- Other Roads
- Ownership
- BLM
- Other

R7W

Elkton Subwatershed Roads

Roads with Erosion Problems

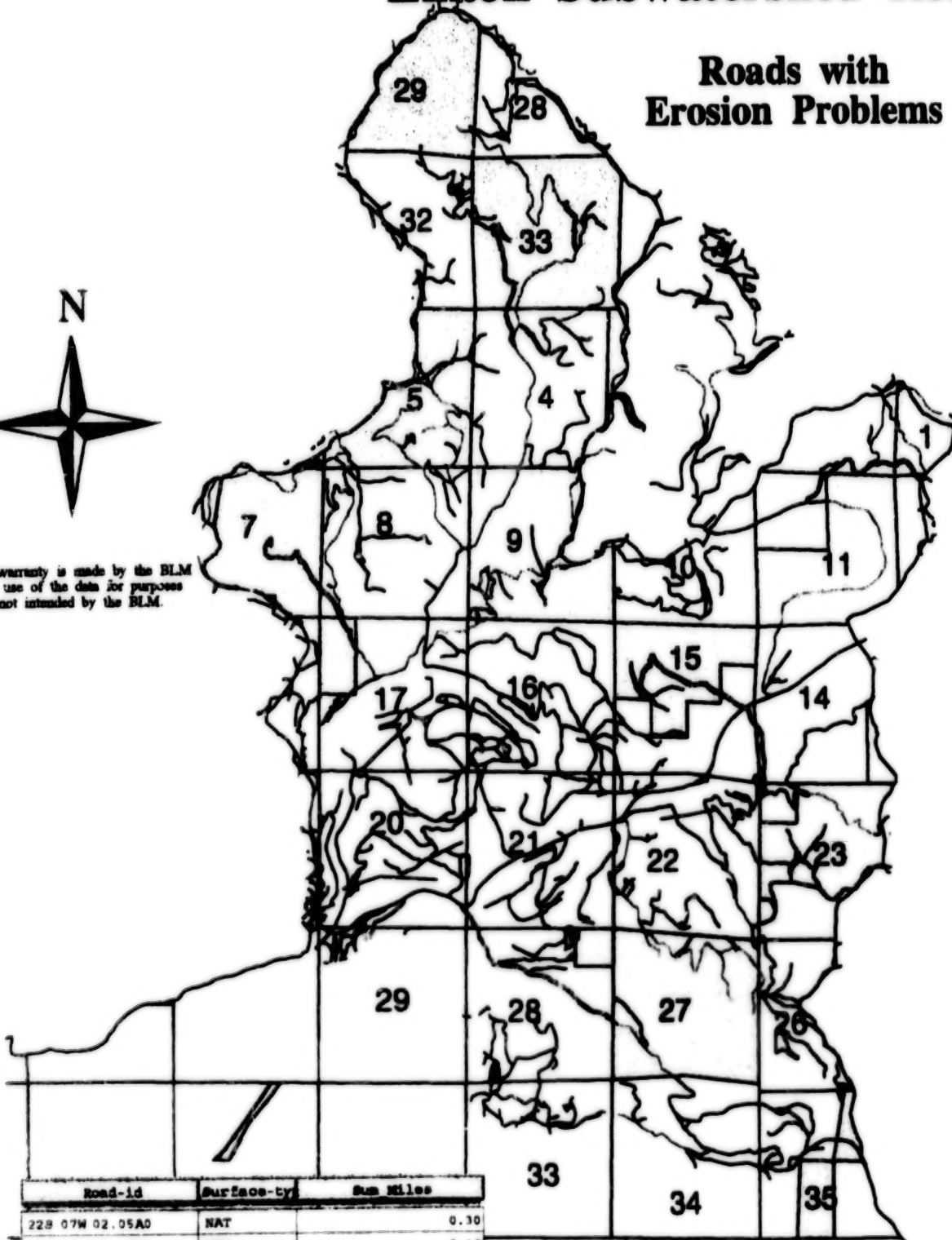
T21S

T22S

N



No warranty is made by the BLM
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not intended by the BLM.



Road-id	Surface-ty	Sum Miles
22S 07W 02.05A0	NAT	0.30
22S 07W 02.05B0	NAT	0.19
22S 07W 04.00A0	NAT	0.53
22S 07W 04.00	NAT	0.48
22S 07W 04.02A	NAT	0.30
22S 07W 11.00A0	NAT	0.62
22S 07W 17.00B0	NAT	0.23
22S 07W 17.02	NAT	0.97
22S 07W 22.01F0	ASC	0.33
22S 07W 23.01A0	NAT	0.47
22S 07W 34.00A		0.30

LEGEND

- Erosion Problems
- Known Road Control
- BLM
- BLM/Prvt
- Prvt/BLM
- PRIVATE
- Other Roads
- Ownership
- BLM
- Other

R7W

Elkton Subwatershed Roads

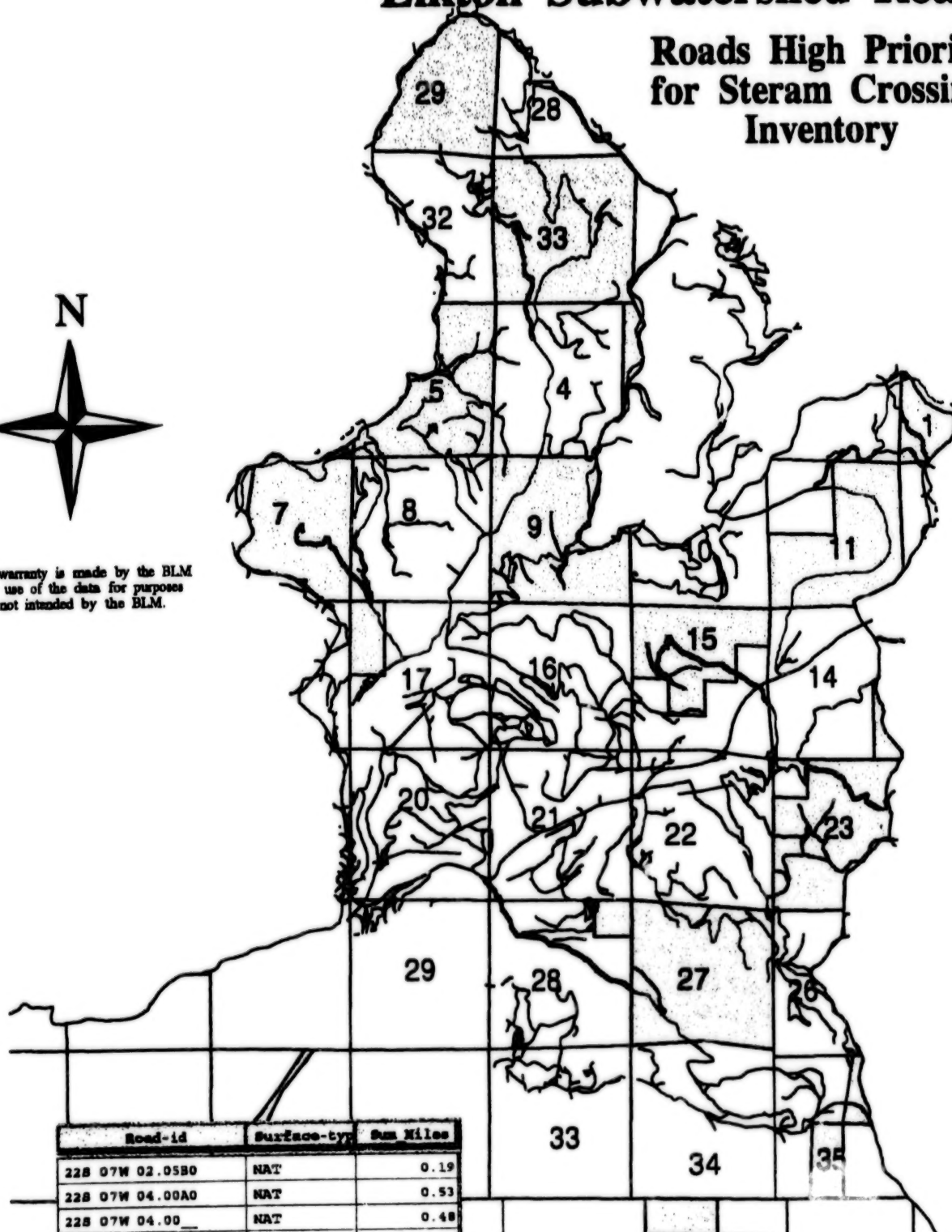
Roads High Priority
for Steram Crossing
Inventory

T21S

T22S



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not intended by the BLM.



Road-Id	Surface-ty	Sum Miles
228 07W 02.0580	NAT	0.19
228 07W 04.00A0	NAT	0.53
228 07W 04.00	NAT	0.48
228 07W 11.00A0	NAT	0.62
228 07W 12.0080	NAT	0.44
228 07W 14.00E0	ASC	0.57
228 07W 17.00C0	NAT	0.62
228 07W 17.02	NAT	0.97
228 07W 20.00A0	ASC	1.39
228 07W 22.0380	NAT	0.08
228 07W 23.00A0	NAT	0.62
228 07W 23.018Z	NAT	0.85

LEGEND
 X High Priority Stream Crossing Inventory
 Known Road Control
 BLM
 BLM/Private
 Private/BLM
 PRIVATE
 Other Roads
 Ownership
 BLM
 Other

R7W

DW	RAN	SEC	SEG	TMO DATE	CONTROL	STANDARD	ACCESS	REMARKS
2 S	07 W	17.00	E	03/16/98	MAIN	MAIN	DECO	ALREADY TANK TRAPPED
2 S	08 W	22.00		03/16/98	MAIN	MAIN	DECO	GATED AND LOCKED/DECO PAST RAW'S SITE
2 S	08 W	24.00		03/16/98	MAIN	MAIN	DECO	AT -25.0 RD
2 S	08 W	24.01		03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	25.00		03/16/98	MAIN	MAIN	DECO	
2 S	08 W	27.00		03/16/98	MAIN	MAIN	DECO	
2 S	08 W	27.01		03/16/98	MAIN	MAIN	DECO	
2 S	08 W	27.02		03/16/98	MAIN	MAIN	DECO	
2 S	08 W	29.01	A	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.01	B	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.02	A	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.02	B	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.02	C	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.02	D	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.02	E	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.02	F	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.02	G	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	29.04	A	03/16/98	MAIN	MAIN	DECO	WITH PERMITTEE APPRV
2 S	08 W	31.02		03/16/98	MAIN	MAIN	DECO	
2 S	08 W	31.04		03/16/98	MAIN	MAIN	DECO	THINNING PLOT
2 S	08 W	32.00	A1	03/16/98	MAIN	MAIN	OPEN	PLANNED T.S./POSSIBLE RD FAILURE
2 S	08 W	32.00	A2	03/16/98	MAIN	MAIN	OPEN	PLANNED T. S./ DECO LAST .2
2 S	08 W	32.01	A	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	32.01	B	03/16/98	MAIN	MAIN	DECO	IN 2002
2 S	08 W	32.02		03/16/98	MAIN	MAIN	OPEN	SAWYER BRIDGE T.S.
2 S	08 W	32.06	B	03/16/98	MAIN	MAIN	DECO	WITH PERMITTEE APPRV
2 S	08 W	33.00		03/16/98	MAIN	MAIN	OPEN	EAS GARRISON & RW WCFR CL @ 33.2
2 S	08 W	33.01		03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	33.02		03/16/98	MAIN	MAIN	OPEN	SAWYER BRIDGE T.S.
2 S	08 W	34.00	A	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	03.00	A	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	03.00	B	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	03.02		03/16/98	MAIN	MAIN	DECO	
2 S	08 W	03.03		03/16/98	MAIN	MAIN	DECO	WITH PERMITTEE APPROV
2 S	08 W	03.04		03/16/98	MAIN	MAIN	DECO	IN 2002
2 S	08 W	05.00	A	03/16/98	MAIN	MAIN	OPEN	SAWYER BRIDGE T.S.
2 S	08 W	05.00	B	03/16/98	MAIN	MAIN	OPEN	SAWYER BRIDGER T.S.
2 S	08 W	05.01		03/16/98	MAIN	MAIN	DECO	
2 S	08 W	05.02	A1	03/16/98	MAIN	MAIN	OPEN	
2 S	08 W	05.02	A2	03/16/98	MAIN	MAIN	DECO	
2 S	08 W	05.03		03/16/98	MAIN	MAIN	FULL	UPPER RD BLCKED BY SLIDE
2 S	08 W	05.04		03/16/98	MAIN	MAIN	DECO	LAST .5 AT PVT JUNCTION
2 S	08 W	05.05		03/16/98	MAIN	MAIN	DECO	LAST .2 AT UN-NUMBERED SPUR

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Unfiltered Query Results

DW	RAN	SEC	SEG	TMO DATE	CONTROL	STANDARD	ACCESS	REMARKS
3 S	08 W	05.06		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	05.07		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	06.03		03/16/98	MAIN	MAIN	DECO	IN2002
3 S	08 W	09.00	A1	03/16/98	MAIN	MAIN	OPEN	CL @9.3 JCT? THINNING
3 S	08 W	09.00	A2	03/16/98	MAIN	MAIN	OPEN	THINNING
3 S	08 W	09.00	B	03/16/98	MAIN	MAIN	OPEN	THINNING
3 S	08 W	09.00	C	03/16/98	MAIN	MAIN	DECO	AT-9.3 JCT. WITH PERMITTEE APPRV
3 S	08 W	09.01		03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	09.04		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	10.05		03/16/98	MAIN	MAIN	DECO	AT PROP LINE
3 S	08 W	10.06		03/16/98	MAIN	MAIN	DECO	2000 WITH PERM APPRV OR AT PROP LINE
3 S	08 W	11.00	A1	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	11.00	A2	03/16/98	MAIN	MAIN	DECO	WITH PERMITTEE APPRV
3 S	08 W	12.00	A1	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	12.00	A2	03/16/98	MAIN	MAIN	DECO	IN 2002
3 S	08 W	13.00		03/16/98	MAIN	MAIN	DECO	IN 2002
3 S	08 W	13.01		03/16/98	MAIN	MAIN	DECO	IN 2002
3 S	08 W	13.02		03/16/98	MAIN	MAIN	DECO	IN 2002
3 S	08 W	13.03		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	15.00	A1	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	15.00	A2	03/16/98	MAIN	MAIN	DECO	PAST BST PORTION
3 S	08 W	15.01		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	16.00	A1	03/16/98	MAIN	MAIN	OPEN	GATED RD
3 S	08 W	16.00	A2	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	16.00	C	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	16.01	C	03/16/98	MAIN	MAIN	DECO	
3 S	08 W	21.00	A1	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	21.01		03/16/98	MAIN	MAIN	DECO	IN 2002
3 S	08 W	21.02		03/16/98	MAIN	MAIN	DECO	IN 2002
3 S	08 W	21.03	A	03/16/98	MAIN	MAIN	OPEN	GOOD DM
3 S	08 W	21.05		03/16/98	MAIN	MAIN	DECO	GOOD DM/ IN 2002
3 S	08 W	23.00		03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	23.01	A	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	23.03		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	23.07		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	25.00	C	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	25.03		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	27.01		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	27.02		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	28.02		03/16/98	MAIN	MAIN	OPEN	WATER HOLE BLK @ 28.3 JCT ? THINNING
3 S	08 W	27.00		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	34.04		03/16/98	MAIN	MAIN	DECO	WITH PERM APPRV OR AT PROP LINE
3 S	08 W	35.00		03/16/98	MAIN	MAIN	DECO	@ 35.1 JCT

OW	RAN	SEC	SEG	TMO DATE	CONTROL	STANDARD	ACCESS	REMARKS
3 S	08 W	35.01		03/16/98	MAIN	MAIN	DECO	● 35.3 JCT
3 S	08 W	35.02		03/16/98	MAIN	MAIN	DECO	WITH PERM APPRV OR AT PROP LINE
3 S	08 W	35.03		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	35.04		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	35.06		03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	35.08		03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	35.09		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	35.10		03/16/98	MAIN	MAIN	DECO	
3 S	08 W	36.01	A	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.01	B	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.01	C	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.01	D	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.01	E	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.02	A	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.02	B	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.02	C	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.03		03/16/98	MAIN	MAIN	DECO	WITH PERMI APPRV OR AT PROP LINE
3 S	08 W	36.06		03/16/98	MAIN	MAIN	DECO	WITH PERM APPRV OR AT PROP LINE
3 S	08 W	36.02	D	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.02	E	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.02	F	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	36.02	G	03/16/98	MAIN	MAIN	OPEN	
3 S	07 W	17.00	C	03/16/98	MAIN	MAIN	OPEN	
3 S	07 W	17.00	E	03/16/98	MAIN	MAIN	OPEN	
3 S	07 W	19.00		03/16/98	MAIN	MAIN	DECO	
3 S	07 W	31.00	A	03/16/98	MAIN	MAIN	OPEN	PROPOSED CULVERT UPGRADE IN W.A.
3 S	07 W	31.00	B	03/16/98	MAIN	MAIN	OPEN	
3 S	08 W	01.09		03/16/98	MAIN	MAIN	DECO	WITH PERMT APPRV
3 S	08 W	02.06		03/16/98	MAIN	MAIN	DECO	WITH PERMIT APPRV IN 2002

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APPENDIX 1: LANDSLIDE INVENTORY

A landslide inventory was done from aerial photography. Time constraints did not allow for any follow up field work for this iteration. The Swiftwater Resource Area has aerial photo coverage from 1959 to 1994. There are eight flights. One big limitation of the inventory is that there was not complete coverage of the Elkton-Umpqua WAU for any of the flights.

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Flight	Percent Coverage	General Location of Missing Coverage
1959	30	Mehl Ck., Elkton and Yellow Ck divisions
July 1964	81	Western Mehl Ck, NE corner of Magee Ck.
July 1965	18	Mehl Ck., Elkton, nearly all of Magee Ck. and most of Yellow Ck.
August 1970	86	Western Mehl Ck.
May 1978	90	Western Mehl Ck.
May 1983	90	Western Mehl Ck.
June 1989	90	Western Mehl Ck.
July 1994	89	Western Mehl Ck.

Since the 1959 coverage is poor and since it is speculative what range of time incorporates the slides seen on these photos, the data from the 1959 photos were not used in most of the analysis. The coverage of the 1965 aerial photos which is also poor was combined with 1970 photos. This may have skewed the results somewhat to a higher percentage of landslides being identified in the Lost Canyon Division than would have otherwise (landslides which occurred in the 1964/65 wet season are more likely to be identified in the 1965 photos than the 1970 photos). Landslide scars which occurred shortly before the photo flight are usually easy to pick out if not hidden by tree canopies because of the high reflectance new disturbances of moved earth give in the photos (white). The smaller slides become difficult to detect after about five to seven years because the high reflectance property of bare earth diminishes with time and vegetation in many cases masks the disturbance.

The 1970 through 1994 aerial photos have about the same coverage.

Other limitations of the inventory:

-Landslides are very difficult to detect under forest canopies, especially the smaller ones. Only twelve landslides were mapped for this inventory. Consequently, no attempt is made to quantify forest landslides and to compare landslide frequencies between forest and management related landslides.

-In the fifties through seventies tractor activity was widespread even where slopes were steep. Some tractor disturbances closely mimicked the appearance of landslide scars. There were a number of situations where it was difficult to distinguish between tractor and landslide scars or to determine if a tractor scar subsequently failed.

-Distinguishing between road and harvest related landslides was often difficult. Where landslides occurred a little below road prisms there was always the question "Was the landslide caused by the possible concentrating of drainage by the road at the initiation point?". There were 27 particularly tough calls and these were noted as "road/harvest related?". In putting together the management related landslide tables, 14 of these landslides were assigned to being road related and 13 were assigned to being harvest related. For the other landslides occurring below roads, those which occurred in sidecast material were judged to be road related. For the other landslides occurring at least 200 feet below the roads and not in sidecast were automatically judged to be harvest related.

-Sidecasting of roadcut material on slopes steeper than the angle of repose (approximately 70 percent) was common in the fifties through seventies. Large volumes of sidecast which traveled far downslope was not considered to be a landslide. Only later secondary movements caused by the failure of overloaded sidecasted slopes were considered landslides. Often it was difficult determining if secondary movement had occurred. High reflectance often washed out any detail such as the possible shadows of scarps which would indicate a landslide subsequently occurred.

-Small landslides (less than 0.1 acre) are believed to have been highly under counted in cleared area and in roads as well as in forests. As already stated in the first paragraph, the smaller slides become difficult to detect after about five to seven years because the high reflectance property of bare earth diminishes with time and vegetation in many cases masks the disturbance. Also, many small roadcut failures are difficult to distinguish from roadcut surfaces which did not fail. The smaller landslides were the ones most easily masked by high density tractor scars of the fifties through seventies. Knowing these limitations, the smallest landslides (approximately .03 acres or less) were purposely not mapped because they were believed to be much more numerous than the numbers of those capable of being confidently detected.

Because of the limitations small landslides pose, they were excluded from certain tables, graphs and analysis. This would be appropriate considering that their impacts on streams are relatively small in comparison with larger landslides in percentage reaching streams and in volume of material. Using only the larger landslides gives pictures of trends from time period to time period. It is the opinion of the Swiftwater soil

scientist who did the survey that a high percentage of the medium or larger landslides that were management related were identified.

The method used of measuring landslide size is not highly accurate. The landslide shapes were drawn onto 7.5 minute USGS quads. When the shape and size of a landslide on a quad sheet were considered fairly accurate it was used to calculate the area. The landslide shape was broken into geometric polygons (squares, rectangles, trapezoids, triangles and circles). Areas were calculated for each polygon and then converted from map area to slope area based on average slopes. The sum of the polygons gave the area. In the case of many torrents, average widths were determined from the aerial photos and then multiplied by the length to get the area. Where the shape and size of a landslide on a quad were not considered accurate (usually the smaller landslides on very steep ground), basically the same procedure was done except that the shape was traced from the aerial photo. Aerial photo scale was determined for the particular elevations involved. The aerial photo which placed the slide in question closest to its center was used.

Another method used was making templates of polygons that approximated common shapes of landslides and that had areas of 0.1, 0.5, 2.0 and 5.0 acres (map area), the breaks between landslides sizes. Landslides which easily fell into a size category using the templates were assigned that category and those that were too close to a size class boundary to confidently determine by this method were calculated using the method in the above paragraph. There is a high likelihood that some borderline landslides were placed in the wrong size category. However, to some unknown degree those landslides placed in too low of category should cancel out those placed in too high of a category.

-A small percentage of the landslides were difficult to confidently place in a particular topographic position.

-A small percentage of the landslides which originated in swales or headwalls were difficult to confidently place in the categories "no stream reached" or first order stream reached".

Significance of Limitations:

The inventory has the most value in ascertaining trends over time and having a feel for certain relative values (except those involving forest related landslides). It is less useful in knowing absolute values, especially in terms of forest related landslides numbers and small landslide numbers. However, as previously stated, it is the opinion of the Swiftwater soil scientist who did the inventory that a high percentage of the medium or larger landslides that were management related were identified. A small percentage of the landslides identified might not in fact be landslides (example, tractor disturbances).

Size of Slide	Number of Landslides							
	Period of Origin							
	≈ 54 to 54*	7/54 to 7/64	7/64 to 8/70	8/70 to 5/78	5/78 to 2/79	2/79 to 1/80	1/80 to 1/81	1/81 to 1/82
Small	5	48	23	31	67	13	11	
Medium	12	49	39	55	55	15	11	
Large	6	16	21	9	10	3	3	
Very Large	1	1	3	2	1	0	0	
Extremely Large	1	0	1	0	1	0	0	
Total	25	114	87	87	134	31	16	4

small = less than 0.1 acre, medium = 0.1 to 0.5 acre
 large = 0.5 to 2.0 acre, very large = 2.0 to 5.0 acre
 extremely large = greater than 0.5 acre

* aerial photo coverage only about 30% of Acl

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in given time period

Size of Slide	Percentage of Landslides (small excluded) ↓						
	Period of Origin						
	≈ 54 to 59	7/59 to 7/64	7/64 to 8/70	8/70 to 5/78	5/78 to 5/83	5/83 to 6/84	6/84 to 7/94
Medium	60.0	74.2	60.9	80.3	82.1	83.3	100
Large	30.0	24.3	32.8	16.1	14.9	16.7	0
Very Large	5.0	1.5	4.7	3.6	1.5	0	0
Extra Large	5.0	0	1.6	0	1.5	0	0
* Total	100	100	100	100	100	100	100

Total landslides within each period constitute 100% base

Size of Slide	Percentage of Landslides (small excluded) ↓						Total
	7/59 to 7/64	7/64 to 8/70	8/70 to 5/78	5/78 to 5/83	5/83 to 6/84	6/84 to 7/94	
	7/59 to 7/64	7/64 to 8/70	8/70 to 5/78	5/78 to 5/83	5/83 to 6/84	6/84 to 7/94	
Medium	17.8	14.1	16.3	19.9	5.4	1.8	75.4
Large	5.8	7.6	3.3	3.6	1.1	0	21.3
Very Large	0.4	1.1	0.7	0.4	0	0	2.5
Extra Large	0	0.4	0	0.4	0	0	0.7
Total	23.9	23.2	20.3	24.3	6.5	1.8	100

100% base = all landslides identified in inventory.

Size of Slide	Average No. of Landslides / Year (Small Excluded)						Total
	7/59 to 7/64	7/64 to 8/70	8/70 to 5/78	5/78 to 5/83	5/83 to 5/90	5/90 to 7/00	
Medium	9.8	6.5	5.6	11.0	2.5	1.0	6.3
Large	3.2	3.5	1.1	2.0	0.5	0	1.9
Very Large	0.20	0.50	0.25	0.20	0	0	0.23
Extra Large	0	0.17	0	0.20	0	0	0.05
Total	13.2	10.7	7.0	13.4	3.0	1.0	8.5

Size of Slide	Approximate Acreage of Landslides (Small Excluded)						Total
	7/59 to 7/64	7/64 to 8/70	8/70 to 5/78	5/78 to 5/83	5/83 to 5/90	6/59 to 7/00	
Medium	14.7	11.7	13.5	16.5	4.5	1.5	62.4
Large	20.0	26.3	11.3	12.5	3.8	0	73.9
Very Large	3.5	10.5	7.0	3.5	0	0	24.5
Extra Large	0	7.0	0	7.0	0	0	14.0
Total	38.2	55.5	31.8	39.5	8.3	1.5	174.8

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Management Relationship	Number of Landslides							
	Period of Origin							
	≈ 1954 to 7/59*	7/59 to 7/64	7/64 to 8/70	8/70 to 5/78	5/78 to 5/83	5/83 to 6/84	6/84 to 7/94	
Forest	1	3	4	0	2	0	2	
Road	10	47	28	10	12	0	2	
Harvest	14	61	33	11	18	0	0	60
Pool	0	3	2	0	0	0	0	0
Total	25	113	87	87	132	30	16	4

* aerial photo coverage only about 50% of LAU

Management Relationship	Percentage of Landslides (Road + Harvest = 100%)							
	Period of Origin							
	≈ 1954 to 7/59*	7/59 to 7/64	7/64 to 8/70	8/70 to 5/78	5/78 to 5/83	5/83 to 6/84	6/84 to 7/94	Total
Road	42	44	59	33	12	30	0	43
Harvest	58	56	41	47	68	70	100	57
Total*	100	100	100	100	100	100	100	100

Total landslides within each period constitutes 100% base

Size of Landslide	Number of Landslides Management Relationship				Total
	Road	Harvest	Forest	Pasture	
Small	39	151	4	1	198
Medium	115	100	3	2	220
Large	73	16	3	3	65
Very Large	4	3	1	0	8
Extra Large	1	1	1	0	3
Total	202	271	12	9	494

Size of Landslide	Percentage of Landslides (small excluded) Management Relationship		Total
	Road	Harvest	
Medium	40.6	35.3	76.0
Large	15.2	5.7	20.8
Very Large	1.4	1.1	2.5
Extra Large	0.4	0.4	0.7
Total	57.6	42.4	100

Management Grouping	Average Number of Landslides / Year -						Total Period
	7/54 to 7/54	7/54 to 7/70	5/70 to 5/78	5/78 to 5/83	5/83 to 6/89	6/89 to 7/94	7/54 to 7/94
Road segment	9.4 12.2	8.0 5.5	5.8 5.2	8.4 17.6	1.5 3.5	0 2.6	5.5 7.3
Total	21.6	13.5	11.0	26.0	5.0	2.6	12.8

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Highest Stream to Reached	Number of Landslides						
	Period of Origin						
	≈ 1954 to 7/59	7/59 to 7/64	7/64 to 8/70	8/70 to 1/75	1/75 to 1/80	1/80 to 1/85	1/85 to 1/90
None	5	35	27	30	40	10	1
1st	4	38	30	26	30	10	1
2nd	5	26	11	10	30	10	1
3rd	8	13	17	0	10	10	1
4th	2	1	1	0	10	10	1
5-7th	0	0	0	0	10	10	1
Umpqua	1	1	1	1	1	1	1
Total	25	114	57	57	134	50	10

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		Percentage of Landslides						
Harvest		Period of Origin						
Stream Order	~ 1954	7/59 to	7/64 to	8/70 to	5/75 to	5/86 to	5/91 to	
Reached	to 7/59	7/64	8/70	5/75	5/86	5/91	5/96	
None	20.0	30.7	31.0	34.5	33.6	38.7	68.7	
1st & 2nd	36.0	56.1	47.1	48.3	50.8	54.8	31.3	
3rd to 7th	40.0	12.3	20.7	12.6	14.9	6.5	0.0	
Umpqua	4.0	0.9	1.2	4.6	0.7	0.0	0.0	
Total	100	100	100	100	100	100	100	1

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Size of Landslide	<u>Number of Landslides</u>						
	<u>Highest Order of Stream Reached</u>						
	None	1st	2nd	3rd	4th	5th to 7th	Unkn
Small	104	52	26	12			
Medium	57	75	14	3	5		
Large	4	18	22	6	-		
Very Large	0		3				
Extra Large	0	0	0	2			
Total	165	146	100	66	7	2	8

Size of Landslide	Percentage of Landslides (sum = 100%)				Tot (not to Un
	Highest Order of Stream Reached				
	None	1st & 2nd	3rd to 7th	Unknown	
Medium	19.3	41.9	11.8		
Large	1.3	13.5	6.8	1.4	74.
Very Large	0.0	1.4	0.7	0.3	22.
Extra Large	0.0	0.0	1.0	0.7	2.
				0	1.0
Total	20.6	56.8	20.3	2.4	100

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Size of andslide	Number of Landslides							Tot
	Highest Order of Stream Reached							
	None	1rst	2nd	3rd	4th	5th to 7th	Unpqua	
Small	104	52	26	13	1	1	1	19
Medium	57	75	49	34	0	1	4	22
Large	4	18	22	16	4	0	1	6
Very Large	0	1	3	1	1	0	2	—
Extr Large	0	0	0	2	1	0	0	—
Total	165	146	100	66	7	2	8	49

In given stream order category

Size of Landslide	Percentage of Landslides (small excluded)				Tot (no toll)
	Highest Order of Stream Reached				
	None	1st & 2nd	3rd to 7th	Unpqua	
Medium	93.4	73.8	58.2	57.1	74
Large	6.6	23.8	31.3	14.3	22
Very Large	0	2.4	6.0	28.6	2
Extr. Large	0	0	4.5	0	1
Total*	100	100	100	100	10 148

Highest Order of Stream Reached	Percentage of a Landslide Size Category					Total C.A. Lands
	Small	Medium	Large	V. Large	E. Large	
none	52.5	25.9	6.2	0	0	33
1st+2nd	39.4	56.4	61.5	50.0	0	49.
3rd to 7th	7.6	15.9	30.8	25.0	100	15
Umpqua	0.5	1.8	1.5	25.0	0	1.
Total *	100	100	100	100	100	100

* Total landslides within each category constitutes 100% Base.

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